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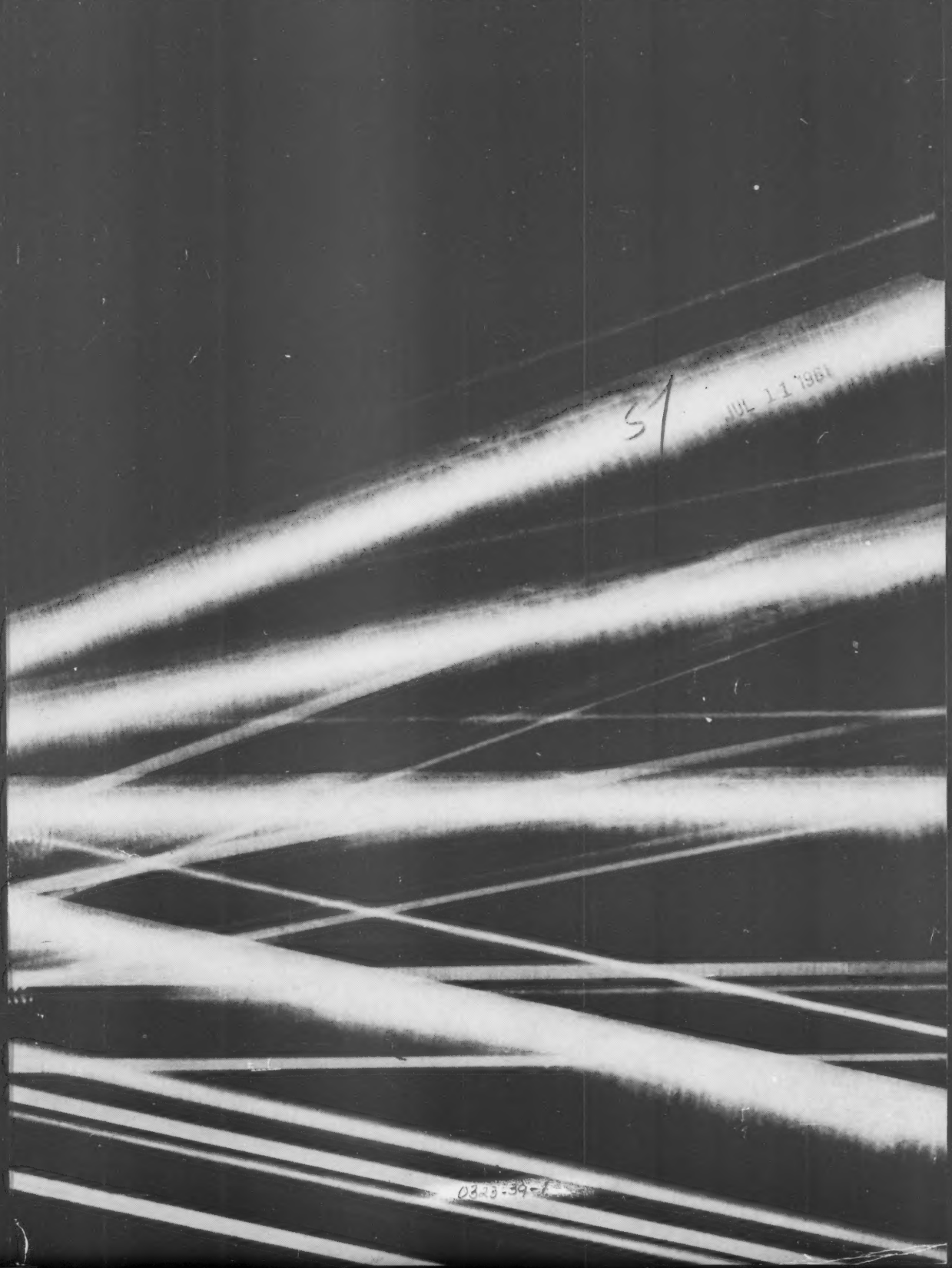

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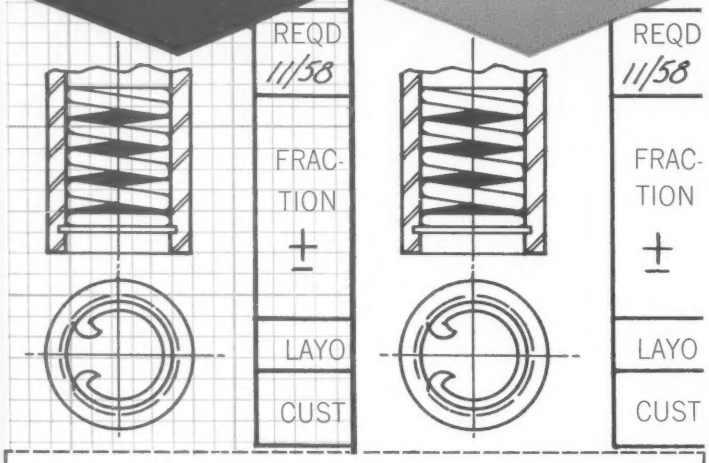

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This month's cover

The simple air cylinder is probably one of the most versatile tools the design engineer has at his call. Ron Vickers, ARPS, our cover photographer, used a multiple exposure technique to record the peregrinations of one installation and came up with this picture. For more details refer to the article on page 60.

In this issue

43 Fluid power solves unique aircraft design problem .... F. N. Newell

An hydraulic system was chosen as the most suitable to operate the world's first swing-tail design for commercial air freighters.

47 Check valves for the simplest control system ..... J. J. Pippenger

Here's a simple guide to selecting the correct type of valve for one of the many thousands of fluid power applications.

50 Air power makes smaller firms competitive ..... I. Walle

Canadian firms can match their "high production" competitors by using a versatile central air control system.

53 Hydraulics helps locate enemy subs ..... B. French

How a Canadian company designed and built a system for raising and lowering sonar detection gear in R.C.N. warships.

56 FPS: doing a big job for fluid power ..... B. Rogers

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60 Cylinders solve production headaches ..... D. Guy and A. D. Kaill

When properly coupled to the right mechanical linkage, the air cylinder can solve almost any motion mechanization problem.

63 Design Show points up new trends ..... T. Stevenson

Some important new trends, both in product design and technical marketing were evidenced at this year's Design Engineering Show.

66 Hole punching requires proper design ..... F. Strasser

The design engineer must know the peculiarities of metal stamping production to ensure increased profits.

82 Do you know your hydraulic fluids? ..... H. Yarnell

This is the first in a series to summarize the most important design and operating features of hydraulic fluids.

90 Bricklayer designs a concrete saw

A Vancouver man's hydraulic-powered saw problem should provide the construction industry with the solution to a long-standing problem.

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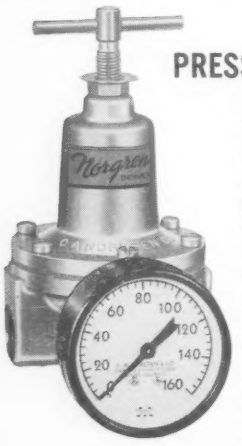

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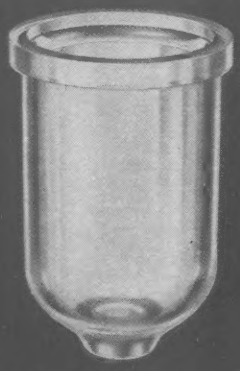

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Design Engineering

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The contributors

Newell

Yarnell

Rogers

French

Pippenger

Fred Newell's youthful interest in motorcycles has developed into active participation, today, in the design of modern aircraft from marine models to helicopters. He's been in the industry since 1937, and as present chief of Canadair Limited's mechanical design section is well qualified to write about the swing-tail operation of the company's newest offspring.

Fred, who was born in Christchurch, England, came to Canada about seven years ago "fully equipped with wife and four children." He was promoted to his present position last year after having been group leader in charge of controls for three years.

Bruce French is a name that will make its mark in the history of the Fluid Power Society in Canada. He was recently elected president of the Toronto Chapter, the first branch to be set up outside the U. S. A. After graduating in mechanical engineering at the University of Toronto he got his first job with Ford Motor Company in plant engineering. He had experience as a designer of test equipment and machine tools, including hydraulic presses, before joining Vickers-Sperry of Canada Ltd. as an application engineer. Eighteen months ago he was appointed district sales manager.

Bruce has three children and this is perhaps the reason he claims to spend most of his spare time as a handyman around the home. In this issue he writes about the Navy's sonar gear.

John Pippenger, who authored the article on check valves, has an unusual hobby related to the publishing trade. In his basement he keeps an old letter press and a collection of wooden and metal type faces which date back to the Civil War. Most of the fonts are still in such good condition that he enjoys printing Civil War posters. His other weakness is for hi-fi stereo music. Both his own car and his wife's are fitted with speakers linked to a tape recorder.

John has a strong background in hydraulics which began with Ford Motor Company and continued with Hydraulic High-speed Valve Products in Manchester, Michigan. As a partner in this company he was involved in a merger which put his present employer Double A Products into the hydraulics business. Today he is vice-president. He is a director of the Fluid Power Society.

Barrett Rogers tells us he gave up the hectic life of a free lance management consultant in 1953 to organize the National Fluid Power Association, thinking it would allow him to take life a little easier. But now he says he's never been busier.

Barrett joined the United States army in 1917, just after graduation from University of Illinois and commanded a battery in France and Germany. He's been in and out of the service ever since and retired after World War II as a colonel. He is now executive vice-president of the Fluid Power Society and authored the article, in this issue, on the society's aims and achievements.

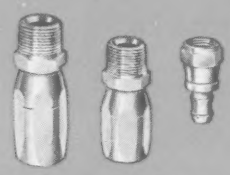
Harold Yarnell tells us he has four bosses — a wife, daughter and two grand daughters. But apparently he is allowed the time off to lead an active life in the Boy Scouts, the Congregational Church and the Fluid Power Society where he helped found the Toledo, Ohio chapter and is its first president. No novice at authoring articles on fluid power, he begins a series on hydraulic oils in this issue of DE.

During his career as a professional mechanical engineer Harold has designed and supervised construction of many things from a bone setting machine to a contour belt sander for curved windshield molds. For the past eleven years he has been an hydraulic engineer with Surface Combustion Division of Midland-Ross Corporation, Toledo.

Irwin Walle, who writes about the central control system, and **Don Guy,** co-author of the article on hydraulic cylinders should be well-known to DE readers. Both contributed in July last year.

These Aeroquip Products Help You Cut Costs . . . Improve Performance

60 Types of Hose in diameter sizes from ⅛" to 7"



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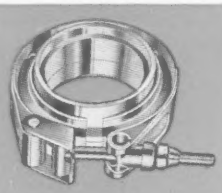

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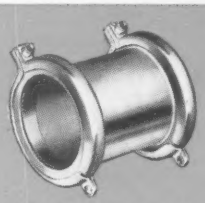

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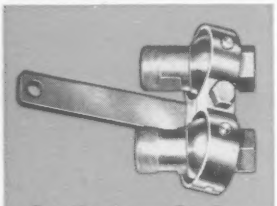
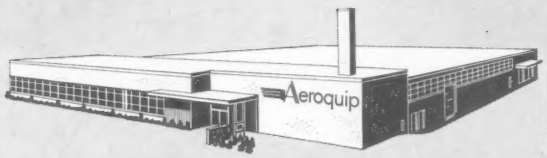


Farm Breakaway Couplings for farm implement hydraulic lines



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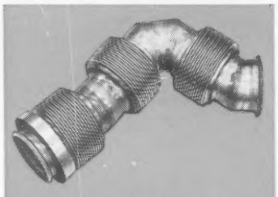

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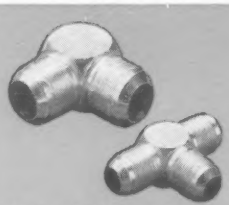

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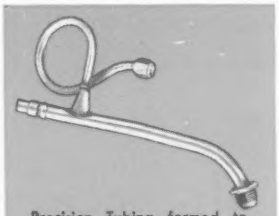

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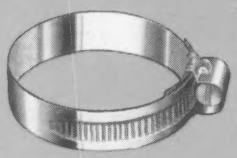

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Reports — A world roundup of engineering and design interest

Neoprene vulcanizates deemed serviceable for 50 years

More than a year before Pearl Harbor specimens of neoprene vulcanizates were mounted outdoors on exposure racks at an experiment station near Wilmington, Delaware. Five, ten and twenty years later scientists measured four physical properties on strips of the original samples to find (a) modulus at 100% elongation; (b) tensile strength; (c) percentage elongation at break; and (d) durometer hardness.

At the same time as the samples were placed outdoors, similar samples cut from the same sheets of neoprene were subjected to controlled laboratory aging tests. One set was given a ten-year exposure in the dark. Another was exposed indoors for four years to diffused light through a skylight, while a third set was artificially aged in an oxygen bomb at 70C and 300 psi. Still a fourth set was put in a 121C air oven.

The same four physical properties were measured on the laboratory samples to correlate the effects of long-term outdoor weathering and results of the various accelerated aging tests. Detailed conclusions were that all samples remained flexible, rubbery and of good appearance after 20 years in the open and it appeared that neoprene vulcanizates might remain serviceable for as long as 50 years outdoors in a temperature climate, if an elongation value of 50% was assumed as the failure point. *Source: Du Pont of Canada Ltd.*

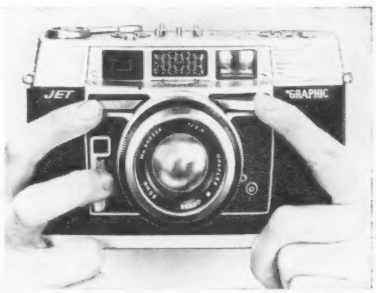
Conveyor system could replace Russian rail network

A Soviet engineer, stationed in Russia's far northerly Vorkuta area, has forecast that a cross-country conveyor belt system may displace costly rail and sea transport in the USSR. Writing in the influential daily business paper "Ekonomicheskaya Gazeta", L. Mataradze, a staff member of the Vorkuta Coal Combine, says that at present a few enthusiasts are quietly working on creation of cross-country conveyor lines. But he says they are firmly convinced a dense conveyor network will cover the country in the near future.

To speed the day, he suggests greater co-ordination between various specialists, institutes and construction bureaus plus establishment of new centers under the authority of the USSR Council of Ministers' Committee for Automation and Machine Construction. He even proposes formation of a Chief Administration for cross-country conveyor transport and assigning several factories to its jurisdiction. In this way he predicts at least three cross-country lines could be constructed between 1962 and 1963 — possibly in the Vorkuta, Krivorog and Kursh regions.

Mataradze says one of the things hindering installation of the conveyors is that Soviet designers have not yet studied their effectiveness for transporting goods more than 120 miles. Another drawback is the short supply of inexpensive, high-strength belting. Present demand is hardly being met.

An automatic camera loaded with carbon dioxide



Snapping family photographs is being made simpler every day. Built-in view finders were followed by automatically coupled exposure meters. Today, the latest improvement is a self-loading and cocking device to save winding on more film for the next shot.

First camera to incorporate this new feature uses a carbon dioxide capsule to power the loading and cocking movement. It is fitted to a new thirty-five millimeter unit and is capable of cycling from six to eight rolls of 20-exposure film. As soon as one shot has been taken it automatically cocks the shutter and advances the film. The camera is fitted with a manual lever for cocking and loading if it is needed.

The carbon dioxide capsule releases the gas at about 1,000 psi when the camera is clicked. The gas forces a piston over a pinion coupling which activates shutter and winding drum. *Source: Graflex, Inc.*

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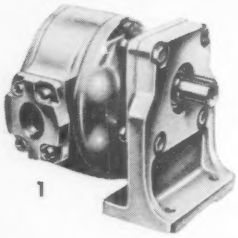

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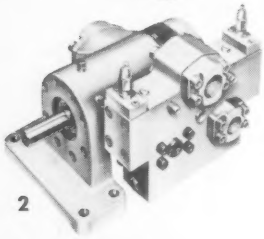

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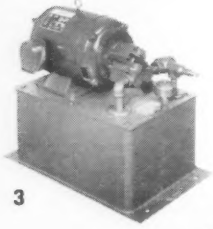

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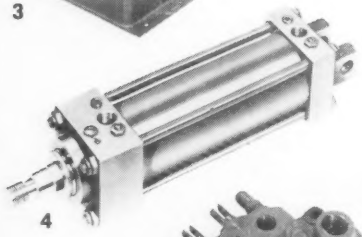

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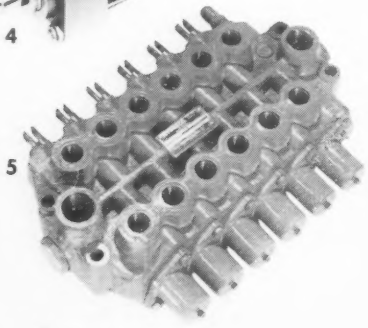

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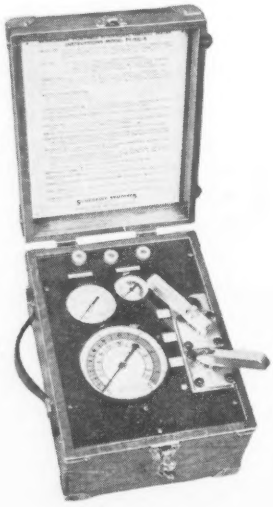

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New nickel steel alloy for resistance to extreme stress

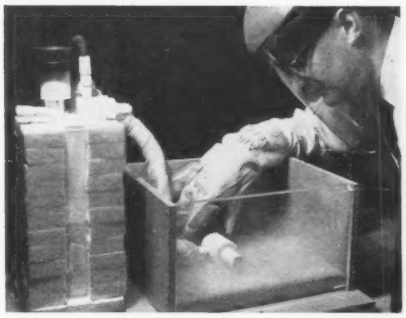
News of metals research this month includes the development of a new 18% nickel alloy steel with unmatched toughness at the highest strength levels of traditional alloy steels. It's claimed to be the only material capable of a yield strength in excess of 250,000 psi while maintaining a nil ductility temperature below —80F.

Another characteristic is its excellent notched tensile strength which exceeds 400,000 psi measured under test conditions with a notch radius .0005 inches. Tests also revealed a resistance to delayed cracking when exposed to a severe corrosive atmosphere in a highly stressed condition.

The new nickel steel alloy can be readily welded by either manual or automatic methods and sound, crack-free welds are achieved even on material in the fully heat-treated condition, without pre-heating.

Source: The International Nickel Company of Canada Ltd.

An air-lubricated bearing for high or low temperatures

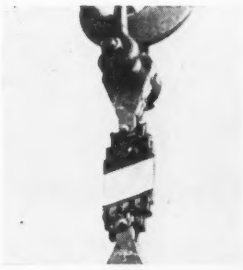


A new concept in the use of air as a bearing lubricant has resulted in development of an externally pressurized step bearing whose load-carrying shaft spins freely on a cushion of compressed air. It is simpler than normal externally pressurized bearings where compressed air is injected through tiny orifices in the shaft housing, forming a low-friction cushion on which the shaft rides.

Employing a single, easily drilled opening, pressurized air enters the shaft housing to become trapped in a shallow recess machined on the shaft. The air then lifts the shaft and becomes the bearing lubricant. The recess traps only enough air to meet load requirements. Air flow is throttled as it escapes from the recess, rather than at the inlet.

The developer has operated step bearings with shafts ranging from ½ to 5 inches in diameter and at speeds up to 100,000 rpm. Ambient operating temperatures have ranged from —330 to 600F. Step bearings are less expensive to produce and use uncomplicated air regulating equipment. They damage less easily than orifice types. *Source: The Boeing Company.*

Glass-to-metal bonded assemblies for rugged applications



Engineers developing a new glass-to-metal attachment for high performance aircraft windshields recently resorted to a spectacular demonstration to try to convince those sceptical of the design principle. They used the attachment in a connecting link to hoist a six and a half ton truck-trailer.

Using an adhesive with suitable shear properties up to 500 F they bonded two metal members to a piece of aluminosilicate glass, six inches square and three eighths of an inch thick. The metal members had a linear coefficient of expansion approximately the same as the glass and were milled by acid etching and stepped on each side toward the center of the glazing.

In answer to the critics the developers claim that intentional application of known forces through a bonded edge attachment in many cases can reduce nominal stress levels and eliminate undesired and unplanned stress concentrations in the glazing.

Glass-to-metal contact obtains direct heat transfer to the edge of the glass, thus reducing drastic temperature gradients and allowing faster heating rates to avoid stress concentrations. Significant stress concentrations at the re-entrant surface are avoided by side-stepping excessive edge fixity of the glass. However use of resilient gasketing material in the area of glass-to-metal contact is not recommended as it would act as an insulator, creating excessive thermal gradients with resultant tensile stress components in the glass.

Apart from the hoisting demonstration, laboratory tests proved no failure after applying a load of 3,000 lbs for 80 hours at 500 F. Further metal-to-metal tests proved the tensile shear strength of the adhesive and there is promise of extending the life of the bonded assembly beyond 1,000 hours at 500 F. *Source: Corning Glass Works.*

Your local Gates Fieldman can give you valuable technical aid for hydraulic hose applications

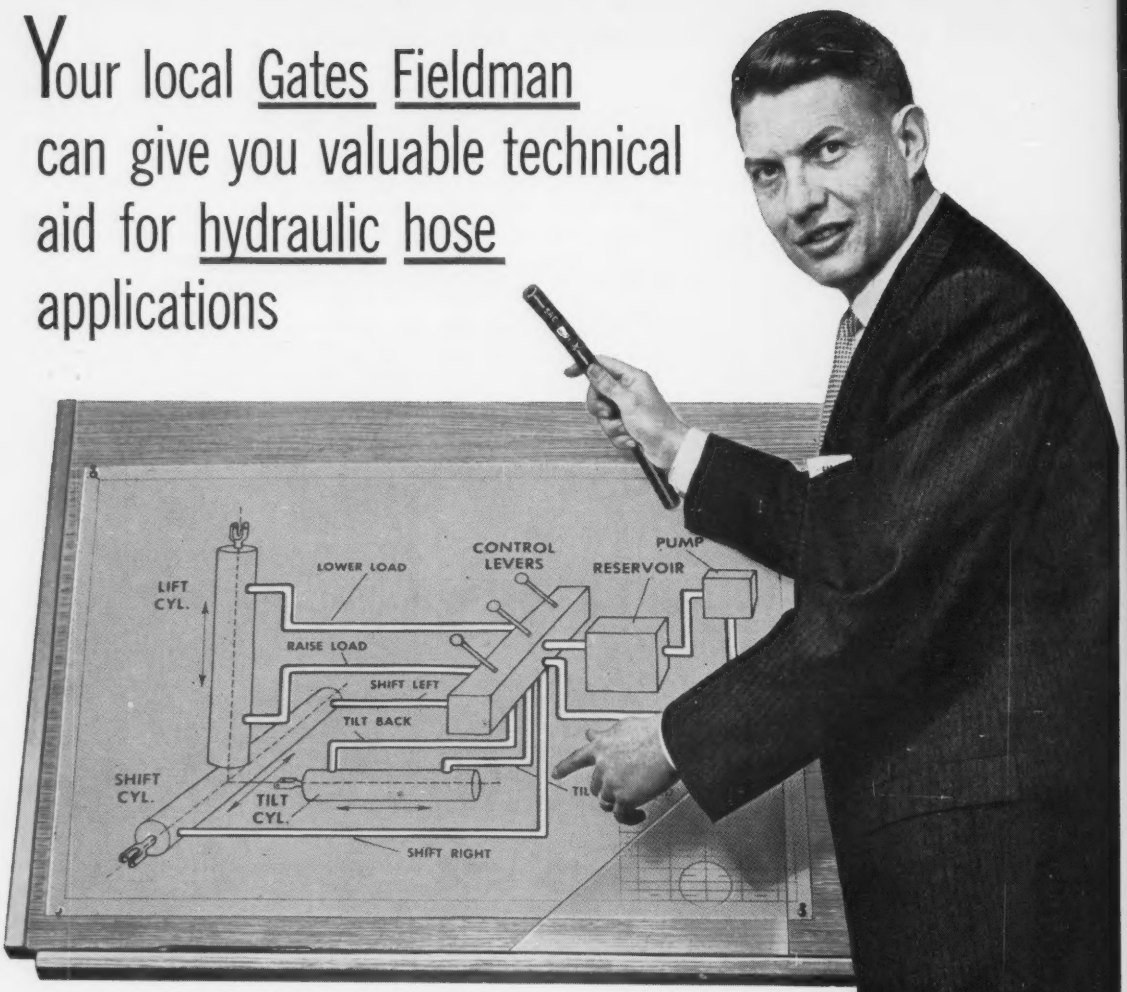


Diagram of hydraulic system in Blackwelder Fork Lifts for every farm material-handling operation. White lines indicate Gates Hose for hydraulic fluid operating lift, tilt and shift cylinders.

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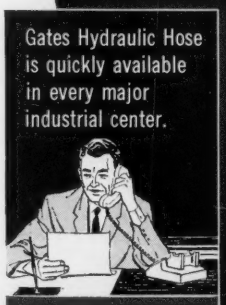

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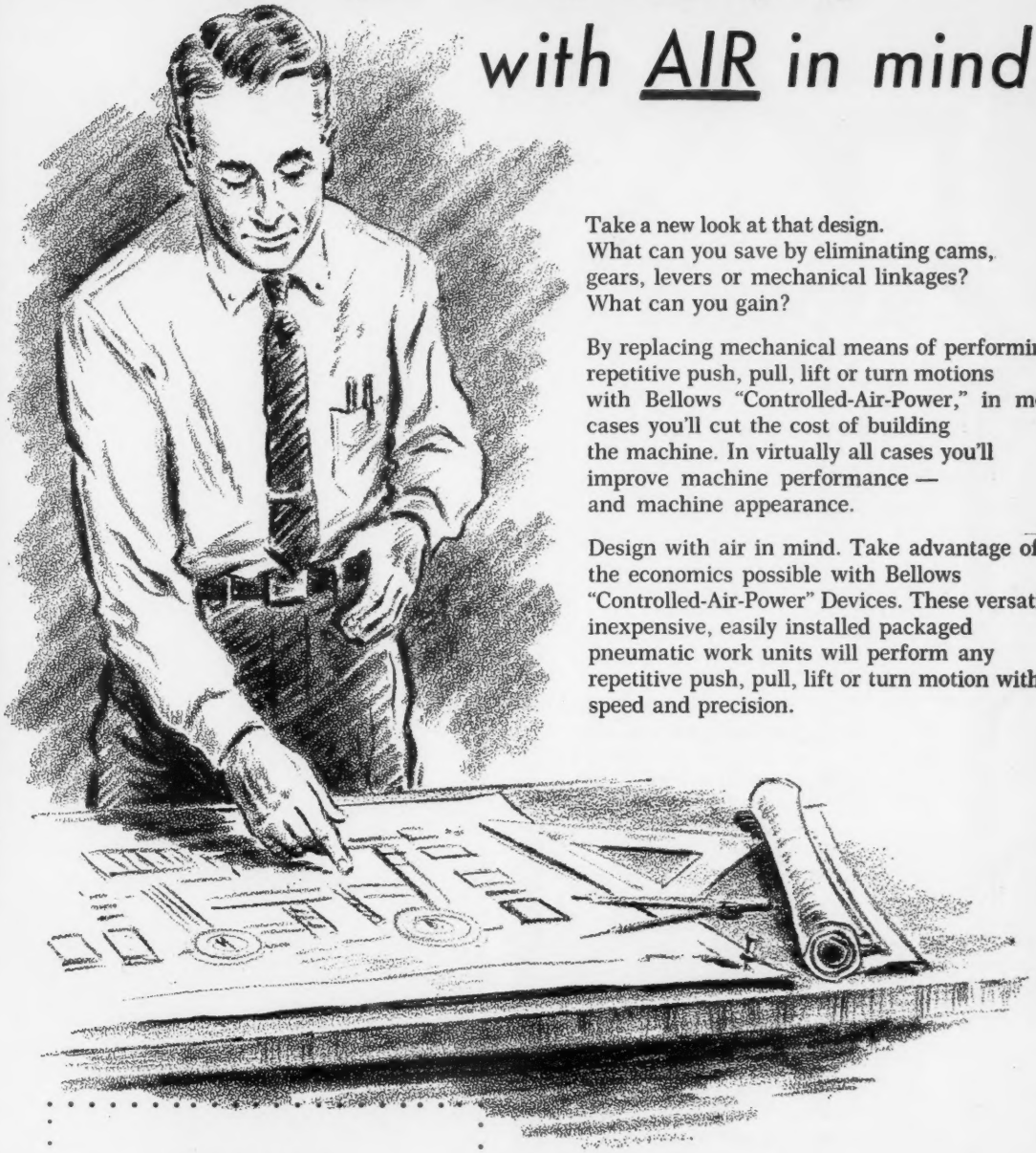

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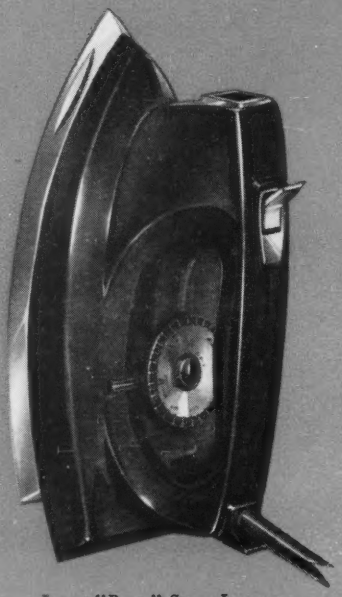

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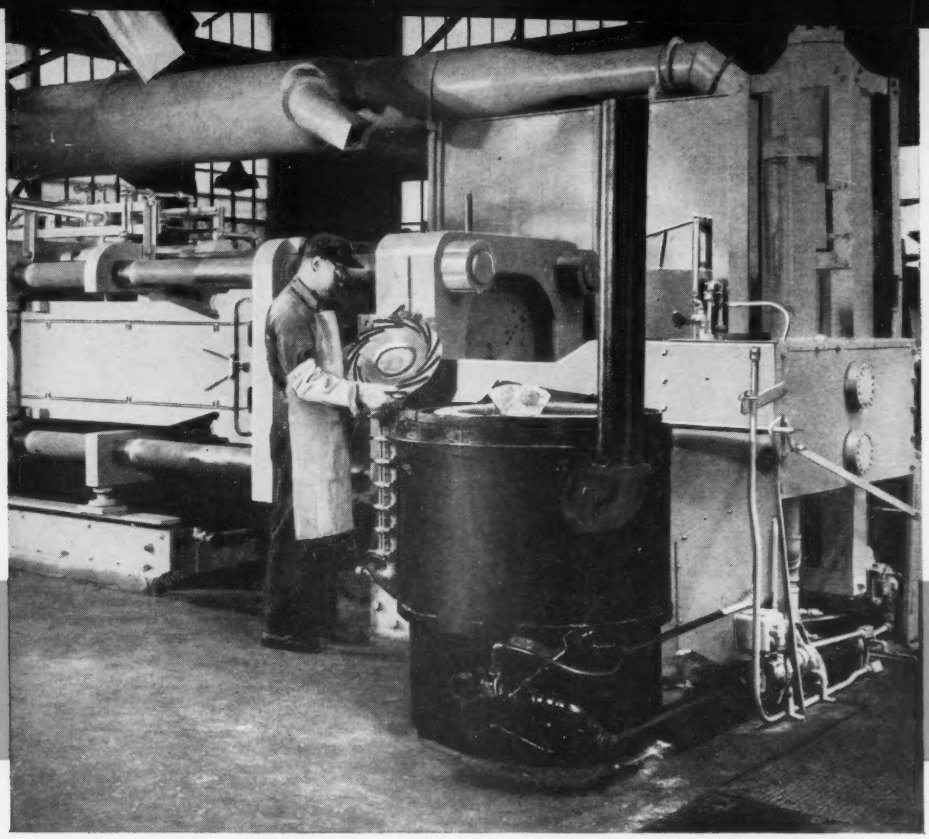

A 750-ton cold chamber die-casting machine at Alcoa's Garwood plant. Holding furnace in foreground containing molten metal is close to pressurized hydraulic lines.

Cellulubes promote safety at Alcoa

where hydraulic lines at 3500 psi pass near molten metal

The danger of fire due to line breaks has been held to a minimum at Alcoa's Garwood Works. In die-casting operations, Aluminum Company of America uses Cellulube fire-resistant hydraulic fluids in the hydraulic system serving the die-casting machines.

Although there have occasionally been line breaks under pressures ranging up to 2,000-3,500 psi, no serious fires have ever resulted. Alcoa has found that Cellulubes not only perform well as hydraulic fluids, but provide excellent lubrication of pump parts.

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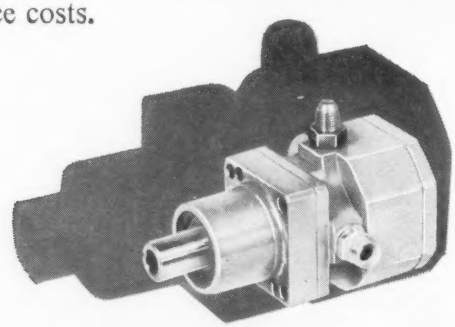

Size of Lucas-Rotax Type IA4 Pump is shown in relation to size of competitive unit of comparable rating.

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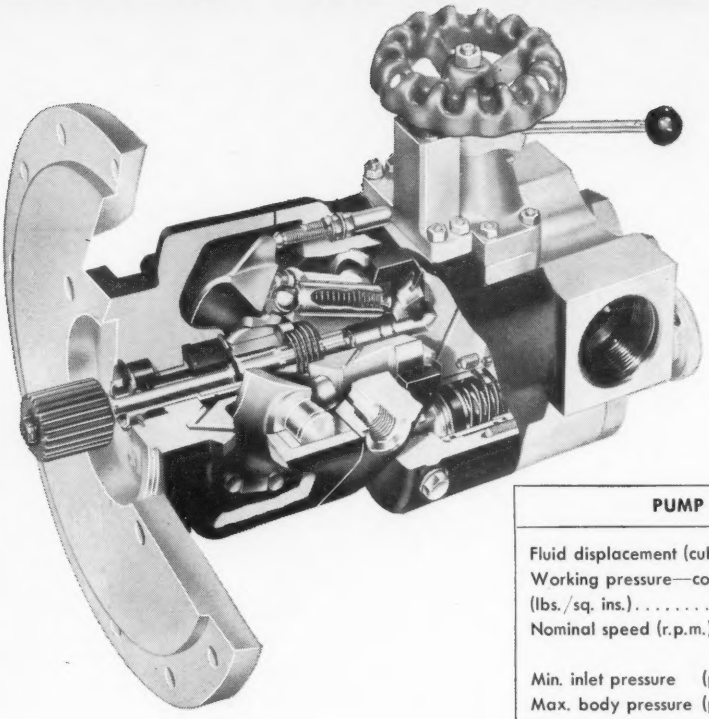

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PUMP DETAIL	BASIC UNIT
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Working pressure—continuous	5000 @ 15 g.p.m.
(lbs./sq. ins.)	3000 @ 30 g.p.m.
Nominal speed (r.p.m.) peak	4000
—continuous	3750
Min. inlet pressure (p.s.i.g.)	10
Max. body pressure (p.s.i.g.)	200
Compensation speed (seconds)	.045
Operating Temperature (°F)	250 to —40
Weight (less A.N.D. flange)	37 lbs.
Direction of rotation (viewed on shaft)	C/Clockwise

Models are available from domestic stock in capacities from 1.5 g.p.m. to 108 g.p.m., capable of pressures up to 5,000 p.s.i. Write for technical literature, or contact the agent or office nearest you for further information.

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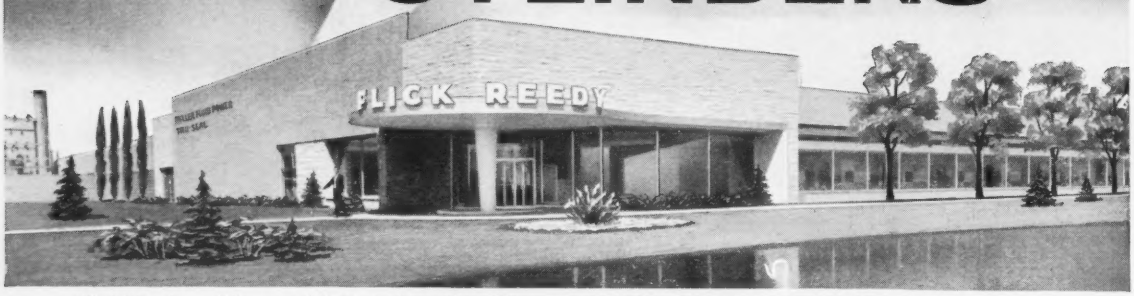

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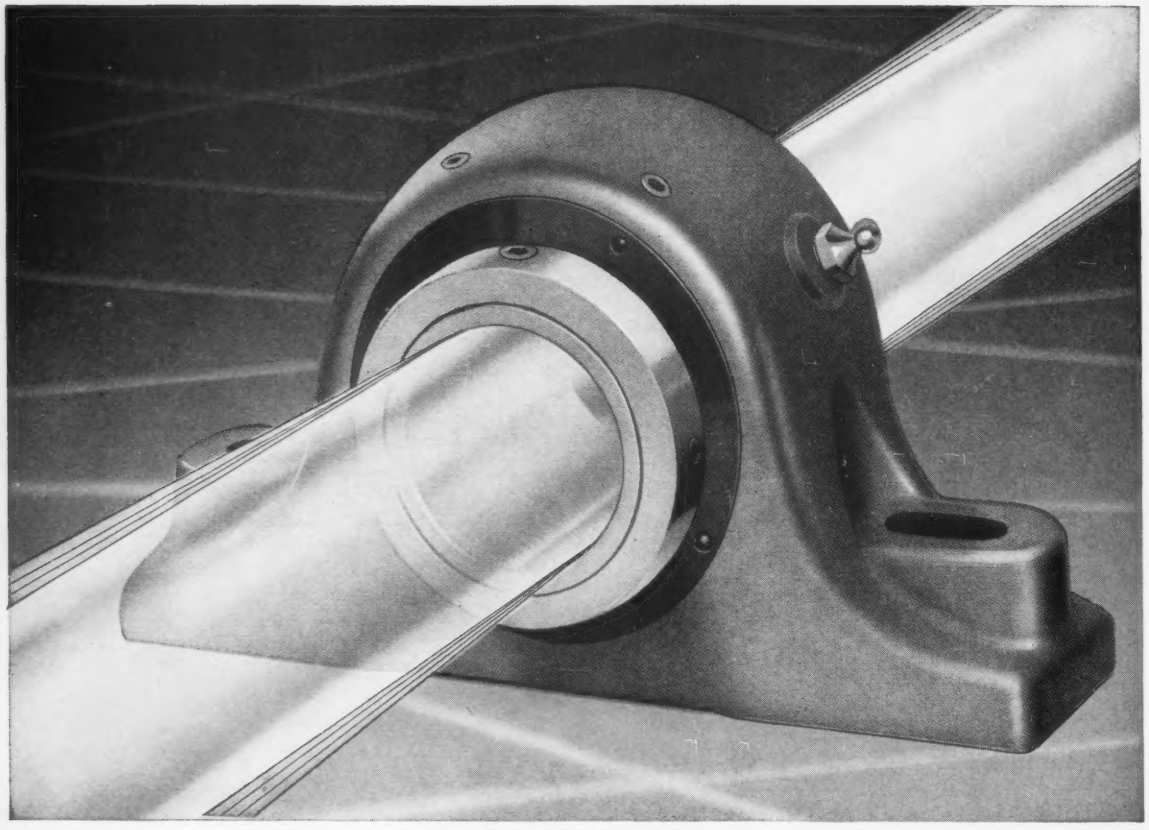

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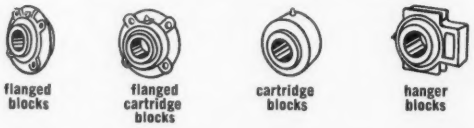

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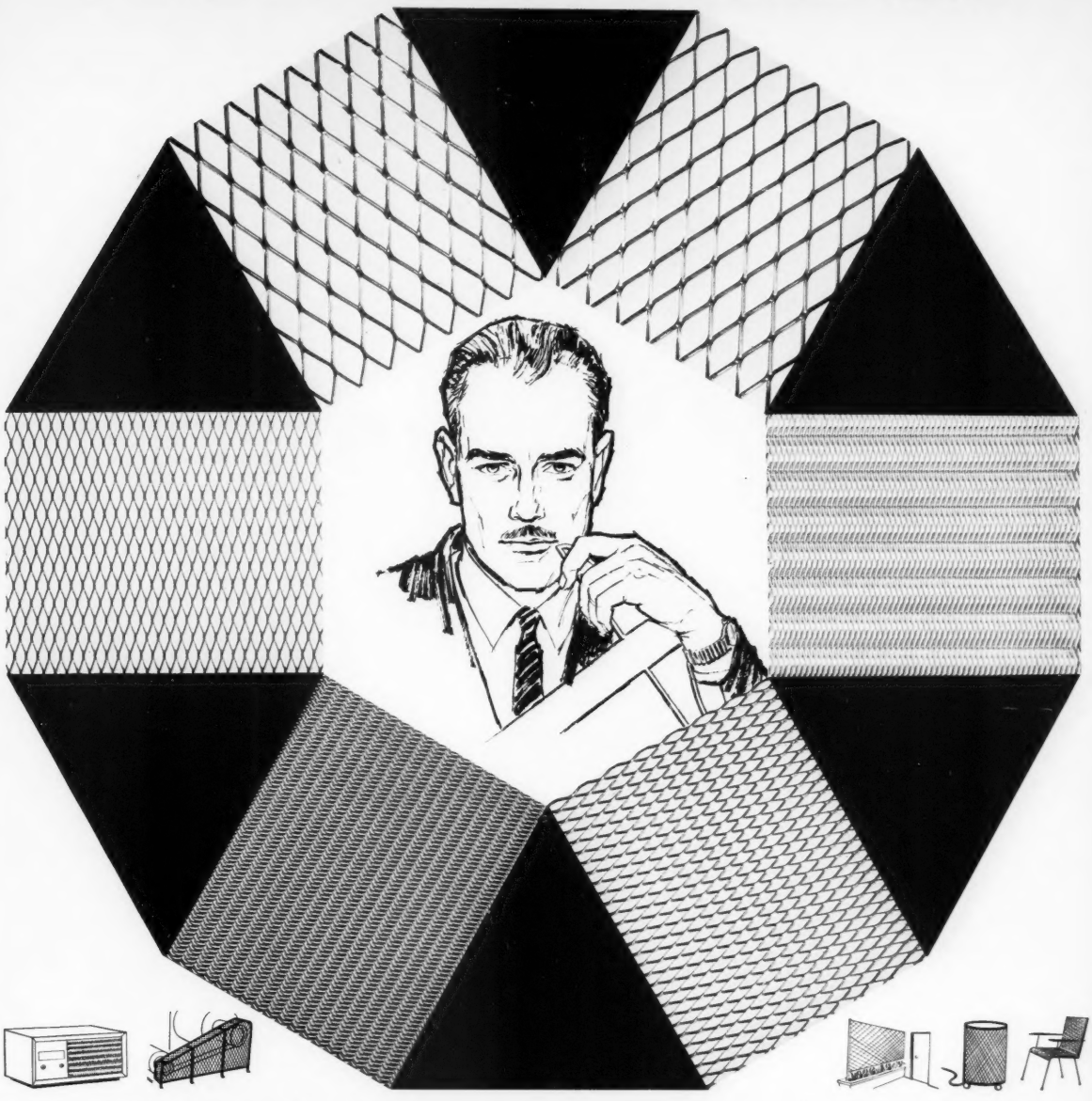

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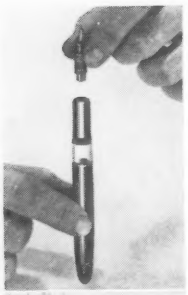

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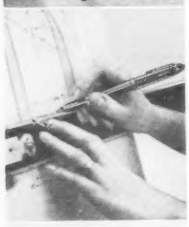

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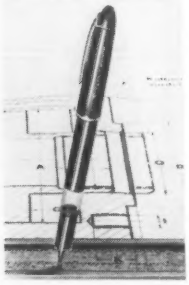

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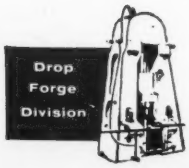
Please quote reference No. 160 when enquiring



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Drop Forge Division, Gananoque, Ontario

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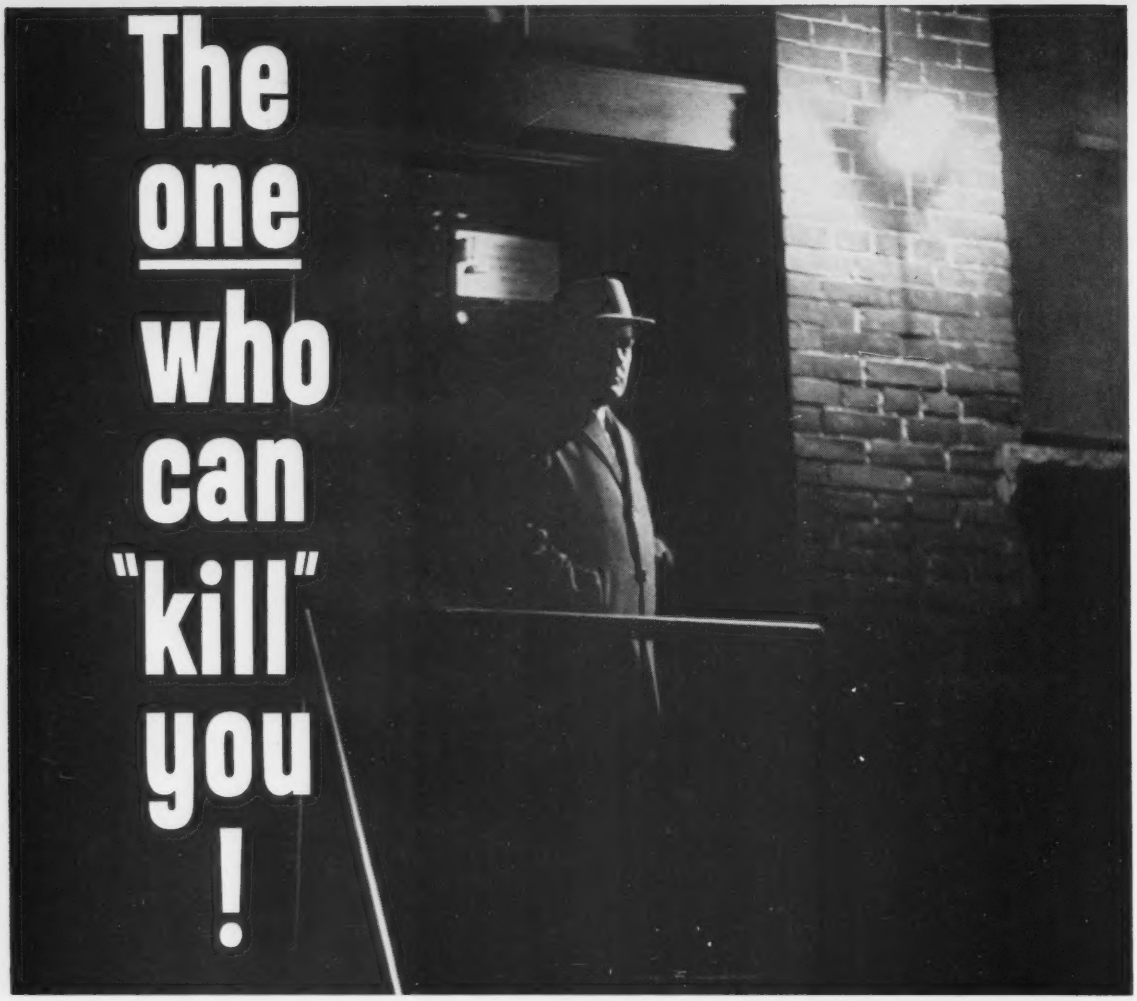
The one who can "kill" you!



Surveys show that an average of three to six men have a voice in recommending, specifying or approving an industrial purchase.

Any one of them may be able to swing the decision your way . . . or "kill" your chances completely.

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BUSINESS NEWSPAPERS

GET YOUR MESSAGE THROUGH CLOSED DOORS TO PEOPLE WHO SPECIFY AND BUY

Design Notes on Fluid Power

RELEASE No. 11: "HOW TO SELECT SYSTEM PRESSURE"

One of the problems in fluid power design is the selection of the nominal operating pressure of your system. You need 50 tons: should you use a 16″ dia. cylinder at 500 psi, or 8″ at 2000 psi, or yet 5″ at 5000 psi? From the point of view of straight theory, one is as good as the other. Your decision will rest on economic considerations: use of standard, readily-available components, low maintenance and down-time, safety, cost, etc. The following notes will be of help:

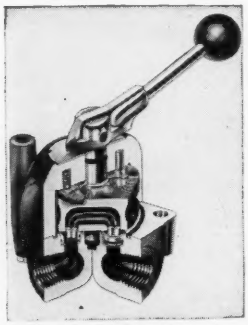
1. The interchangeable (so-called JIC) cylinders are rated for 2000 psi heavy-duty, 3000 psi non-shock. A 3000 psi heavy-duty, 5000 psi non-shock cylinder of superior quality is now available as a standard item, made in Canada.
2. Good vane-type fluid motors are rated for 2000 psi continuous, and piston motors for 3000 to 5000.
3. Vane pumps are also rated for 2000 psi, and piston pumps, for 3000 to 5000.
4. Manual and solenoid valves are available for pressures up to 10,000 psi, but the 3000 psi models are most economical.
5. Most servo valves are rated for 3000 psi.
6. Most flow control valves are rated for 3000 psi maximum, but at least one make is now available for 5000 psi.

It would appear, therefore, that you might economically select 2000 psi as a nominal maximum system pressure, at least up to 50 tons. Beyond 50 tons, compare the 2000 psi to the 3000 psi system: quite often, the higher pressure is cheaper and more compact. It is no longer considered good practice to design for 1000 psi, except under special circumstances.

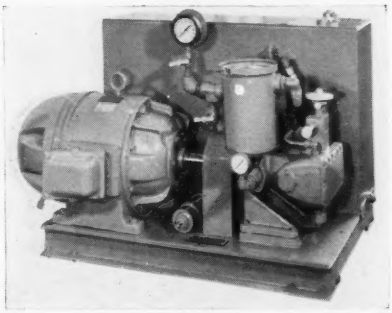
For mobile equipment, remember that low pressure means greater flows, large lines and bulky, heavy components; don't be afraid of going to higher pressures: if all the world's aircraft work at 3000 psi, surely we should be able to work at least at 2000 psi.

There are several mobile units now working satisfactorily in Canada at pressures between 3000 and 5000 psi. Sometimes, one single feature of the system can determine operating pressure. For example, if the application demands a variable-volume pump, then we might as well go to higher pressures since all variable-volume piston-type pumps are rated at least for 2500 psi, and some up to 5000 psi; a 3000 psi design will then be the most satisfactory.

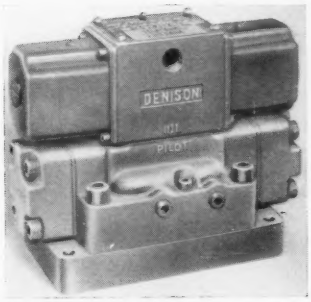
At the moment, it would appear that the most serious limitation on the use of higher pressures occurs when flexible hoses have to be used. Hose and hose fitting manufacturers have done an excellent job of up-grading their product, and no doubt they will continue to do so. In the meantime, you can use hoses at 2000 psi without undue concern, and at 3000 psi up to 30 gpm.



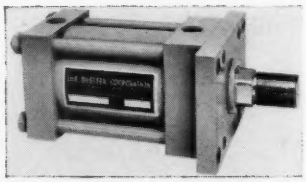
Barksdale SHEAR - SEAL four-way valve, low cost, low maintenance, high reliability. Available for various pressures to 10,000 psi.



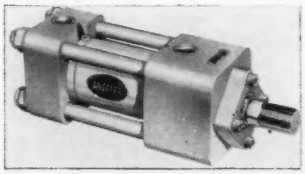
Rousseau's Canadian-designed power unit, built in our own shops to your specifications.



Denison solenoid-pilot four-way valve, for 3000 psi and 5000 psi service.



Sheffer - Viceroy interchangeable cylinder, 2000 psi heavy-duty, 3000 psi non-shock, Canadian-made.



Sheffer - Viceroy ultra - high - pressure cylinder, 3000 psi heavy-duty, 5000 psi non-shock, Canadian-made.

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ROUSSEAU CONTROLS LTD.

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CF-104 PRECISION CONTRACTS TO JARRY HYDRAULICS

Because of a substantial reputation for the ability to produce highly sophisticated equipment, Jarry Hydraulics Limited has been awarded contracts for the Canadair-built CF-104 which will take full advantage of the Company's precision manufacturing skills. These call for Jarry to supply:

The 10 gpm aircraft hydraulic pumps, under licence from the Kellogg Division of American Brake Shoe Co.

Electro-servo valves under licence from Cadillac Gage Co.

Powered flight controls under licence from Bertea Corporation.

In addition to the above, Jarry is manufacturing the main landing gear.

If you have requirements in hydraulics, hydraulic systems or in any area calling for imaginative engineering and precise manufacturing talk to Jarry.

JARRY HYDRAULICS LTD. • MONTREAL 18, CANADA

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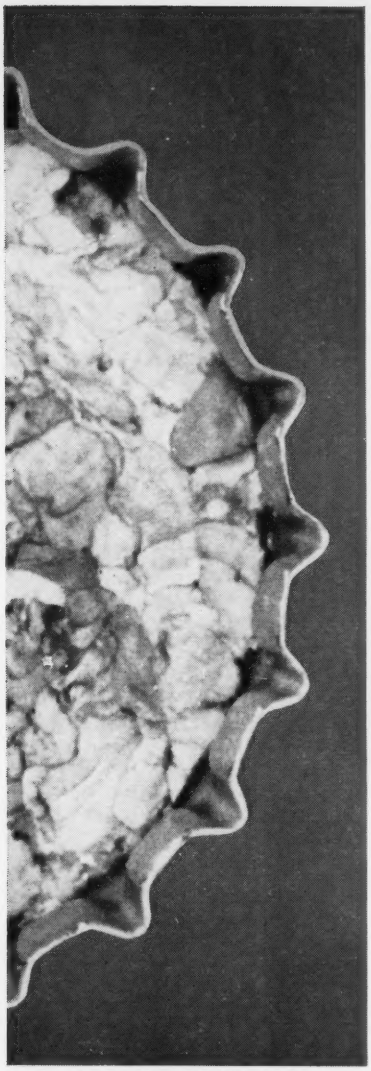
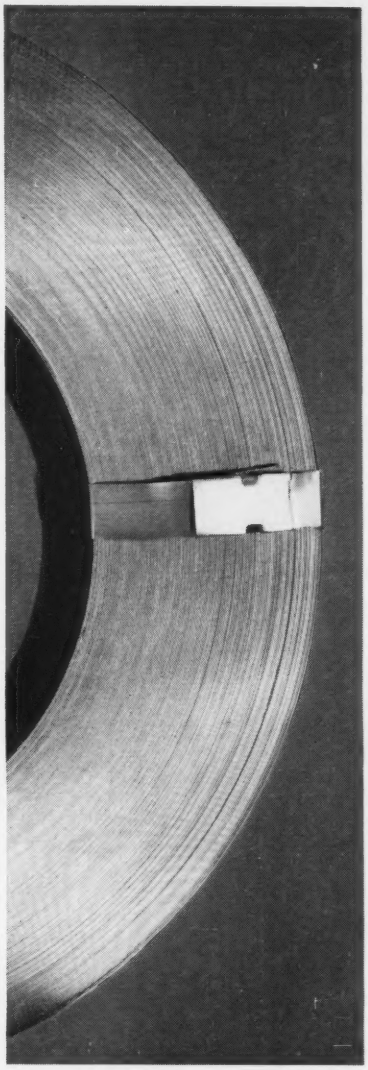
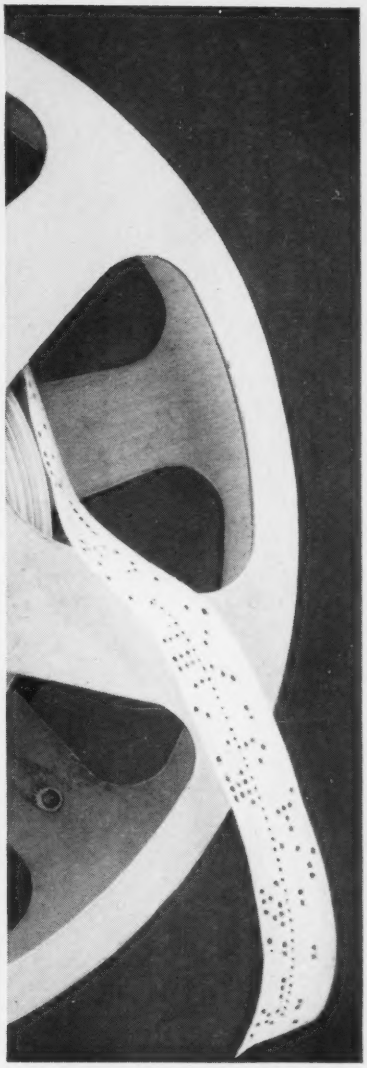
counting controls for industry, defense and space exploration



Counting bottle caps, pills or tiles . . . Veeder-Root electronic counters with photo-electric input record up to a surprising 300,000 units per minute.



Operators in the remote control booth of high-speed strip mills get automatic readings of steel production on Veeder-Root electrical counters.



In industrial automation systems, Veeder-Root remote digital readout coordinates control, makes operating data instantly, constantly available.

Indicate, coordinate, automate...with Veeder-Root counters!

Now get facts fast—facts you can use for stepping up your operation, for integrating parts of it, for activating other equipment, automatically. Veeder-Root counters deliver such key facts with surprising economy. Write Veeder-Root of Canada, Ltd. P.O. Box 156, Toronto 18. **count on...Veeder-Root**

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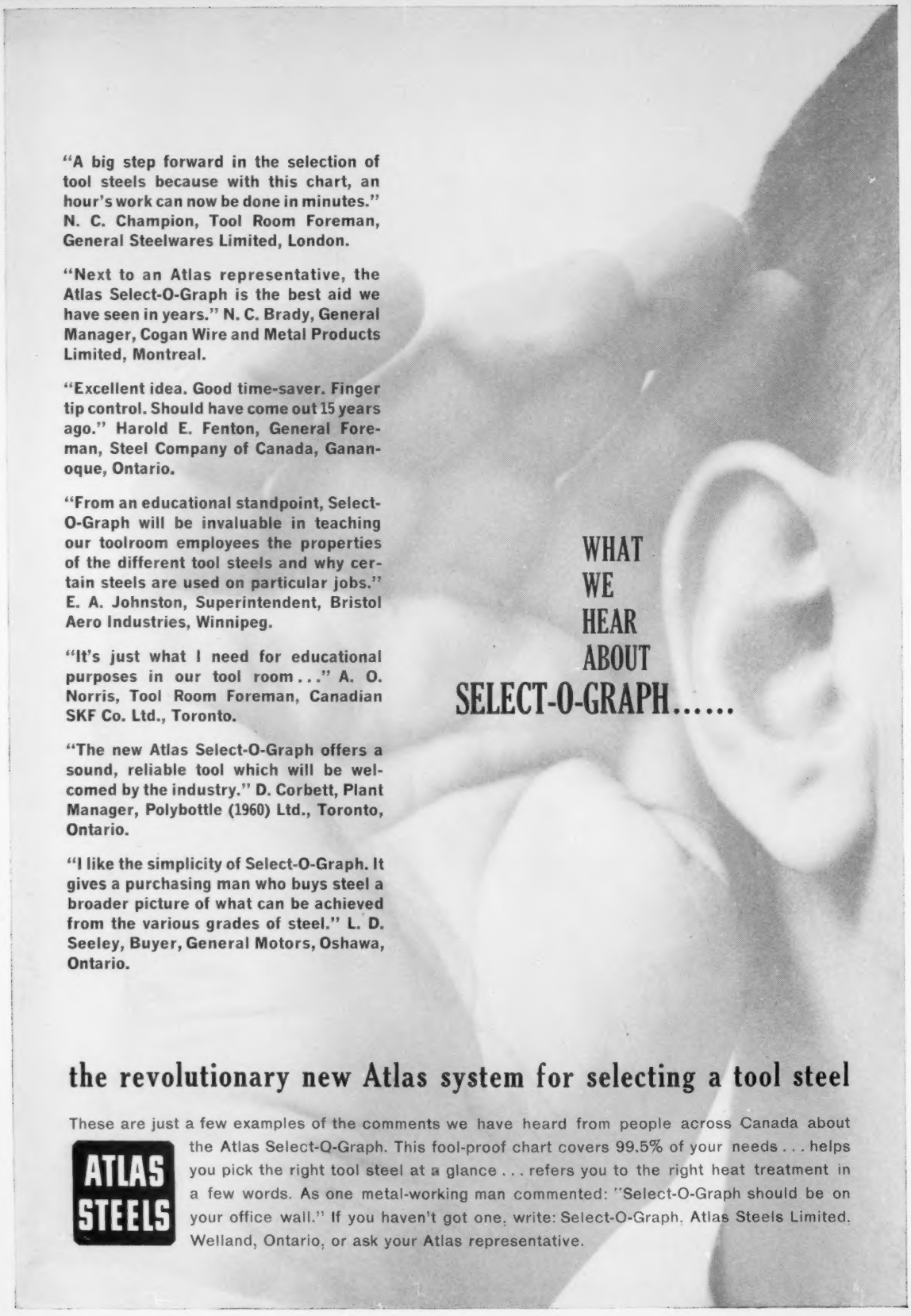

"A big step forward in the selection of tool steels because with this chart, an hour's work can now be done in minutes." N. C. Champion, Tool Room Foreman, General Steelwares Limited, London.

"Next to an Atlas representative, the Atlas Select-O-Graph is the best aid we have seen in years." N. C. Brady, General Manager, Cogan Wire and Metal Products Limited, Montreal.

"Excellent idea. Good time-saver. Finger tip control. Should have come out 15 years ago." Harold E. Fenton, General Foreman, Steel Company of Canada, Gananoque, Ontario.

"From an educational standpoint, Select-O-Graph will be invaluable in teaching our toolroom employees the properties of the different tool steels and why certain steels are used on particular jobs." E. A. Johnston, Superintendent, Bristol Aero Industries, Winnipeg.

"It's just what I need for educational purposes in our tool room..." A. O. Norris, Tool Room Foreman, Canadian SKF Co. Ltd., Toronto.

"The new Atlas Select-O-Graph offers a sound, reliable tool which will be welcomed by the industry." D. Corbett, Plant Manager, Polybottle (1960) Ltd., Toronto, Ontario.

"I like the simplicity of Select-O-Graph. It gives a purchasing man who buys steel a broader picture of what can be achieved from the various grades of steel." L. D. Seeley, Buyer, General Motors, Oshawa, Ontario.

WHAT WE HEAR ABOUT SELECT-O-GRAPH.....

the revolutionary new Atlas system for selecting a tool steel

These are just a few examples of the comments we have heard from people across Canada about the Atlas Select-O-Graph. This fool-proof chart covers 99.5% of your needs . . . helps you pick the right tool steel at a glance . . . refers you to the right heat treatment in a few words. As one metal-working man commented: "Select-O-Graph should be on your office wall." If you haven't got one, write: Select-O-Graph, Atlas Steels Limited, Welland, Ontario, or ask your Atlas representative.

ATLAS STEELS

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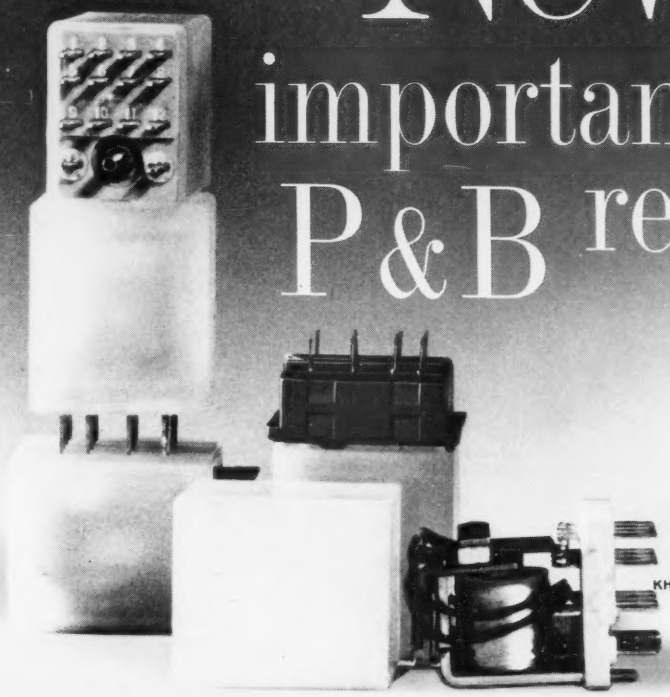
a New and important P&B relay . . .

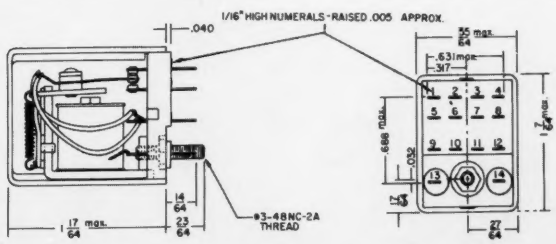


KHP SERIES SHOWN ACTUAL SIZE

having rare longevity

This small, 4-pole relay has the happy faculty of maintaining its original operating tolerances over an exceptionally long life. Example: tests (by customers!) show this relay has variations in electrical characteristics of less than 5% after more than 100 million operations.

But that's far from all. This is a *small* relay . . . about a one inch cube. This relay is easy to install using the conveniently spaced solder lugs or a socket. Thus you save time and production costs. This relay is versatile . . . its 4PDT contacts will switch loads from dry circuit up to 3 amperes. This relay—well, why not order samples and see for yourself! Order today from your P&B representative or write us direct.



KHP SERIES SPECIFICATIONS

CONTACTS:
Arrangement: 4 Form C, 2 Form Z.

Material: 1/2" dia. Silver standard. Silver cadmium oxide and gold alloy available.

Rating: 3 amps @ 30 volts DC or 115 volts AC resistive for 100,000 operations.

COILS:
Resistance: 11,000 ohms max.

Temperature: Operating Ambient: —45°C. to +70°C.

Power: 0.5 watts min. operate @ 25°C. 0.9 watts nom. @ 25°C. 2.0 watts max. @ 25°C.

TIMING VALUES:

Nominal Voltage @ 25°C.	Max. Values
Pull-in time	15 ms
Drop-out time	5 ms

INSULATION RESISTANCE: 1500 megohms min.

DIELECTRIC STRENGTH:
500 Volts RMS 60 cycles between contacts.
1000 Volts RMS 60 cycles between other elements.

MECH. LIFE: In excess of 100 million cycles.

SOCKET: Solder lug or printed circuit terminals. Available as accessory.

DUST COVER: Standard.

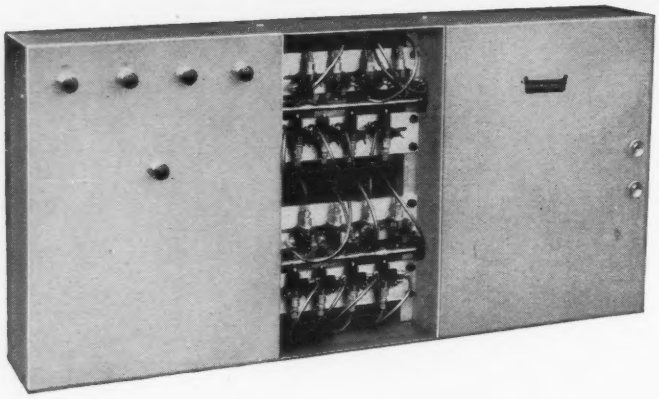
TERMINALS: Solder lug and taper tab.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR

POTTER & BRUMFIELD

DIVISION OF AMF CANADA LIMITED • OXFORD STREET, GUELPH, ONTARIO

As fabled as perpetual motion...



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perfects a

Low cost Universal Pneumatic* Control Circuit!

This single circuit can do the job of *any* and *all* of the custom-designed pneumatic controls now in operation or on the drawing boards. It can be transferred from one control operation to another as swiftly as a call is routed through a telephone switchboard. It can and will soon replace conventional custom circuits in all industrial applications!

In print, the virtually limitless versatility of the new MAXAM Universal Control Circuit may seem difficult to believe; when you see it in action, you'll find it impossible to deny. For a demonstration, call or write:

Holman
PNEUMATIC EQUIPMENT

MAXAM—NOPAK DIVISION

HOLMAN BROS. (CANADA) LTD.

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For sales and service on MAXAM or NOPAK, contact:
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**Applicable for hydraulic as well as pneumatic operation.*

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manufactures the largest variety of Anti-Friction bearings for the most applications

- High-precision instrument ball bearings
- Deep groove ball bearings
- Angular contact ball bearings
- Magneto type ball bearings
- Double row rigid ball bearings
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- Thrust ball bearings
- Cylindrical roller bearings
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- Single row self-aligning spherical roller bearings
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- Aircraft bearings
- Airframe bearings
- Water pump shaft assemblies
- (Railway) Axle box bearings
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- (Bearing) Accessory parts
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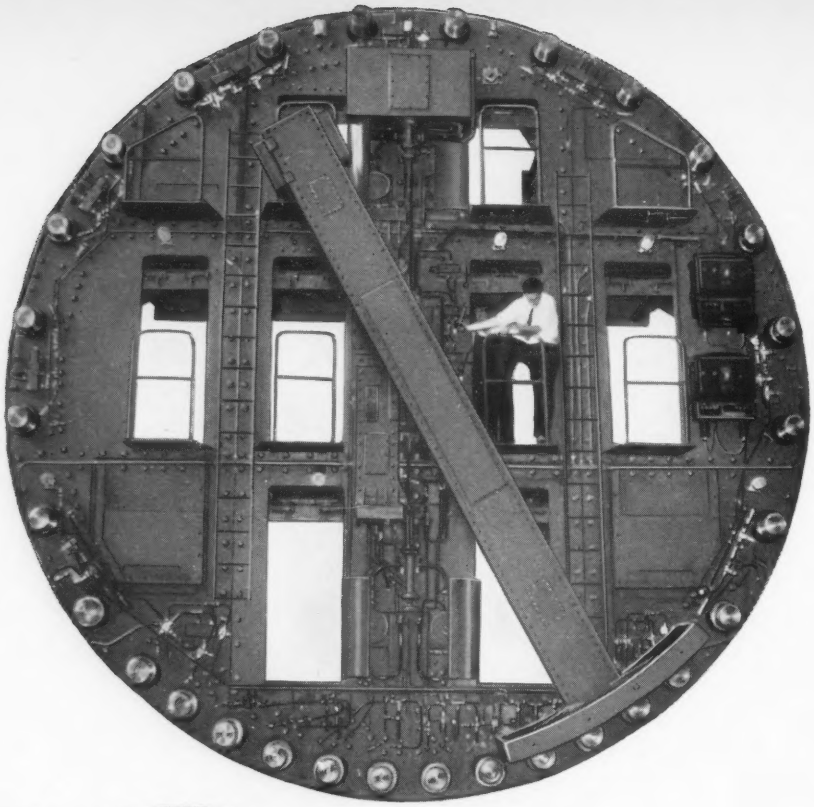

50 BELOW IN TORONTO!

50 feet below busy downtown traffic in Toronto, a giant shield moves slowly forward. At regular intervals, the great arm places in position the liners which form the walls of the city's new subway extension. The shield, illustrated above, one of six produced, is a huge complex of hydraulic jacks, each exerting 110 tons thrust. They are mounted, with controls, in a precision machined fabricated steel frame. Note the man standing in one of the compartments during shop testing. Shields and lining (22,000 tons of machined cast iron segments) were produced by Canada Iron.

At Canada Iron's modern 93,000 sq. ft. machinery plant at Trois Rivieres, Quebec, design engineers and skilled workmen take genuine pride in producing quality custom machinery for many Canadian industries and for export abroad.

Call in Canada Iron sales engineers to discuss *your* machinery requirements.

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CI
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ANNOUNCEMENT

SPERRY GYROSCOPE OTTAWA LIMITED

now exclusive manufacturer and distributor for

Industrial Timer CORPORATION

Until today, no industrial time control designed by Industrial Timer Corporation had ever been manufactured by a Canadian firm. We are pleased, then, to announce that Sperry Gyroscope Ottawa Limited are now exclusive agents for the manufacture and sale of all products designed by Industrial Timer Corporation.

- Recycling Timers
- Time Delay Timers
- Time-O-Lite Products
- Interval Timers
- Time totalizers

INDUSTRIAL TIMER CORPORATION

SPERRY

SPERRY GYROSCOPE OTTAWA LIMITED
P. O. Box 90, Ottawa, Ont.

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"SPECIAL" STEELS FOR INDUSTRY...

STELCOLOY*

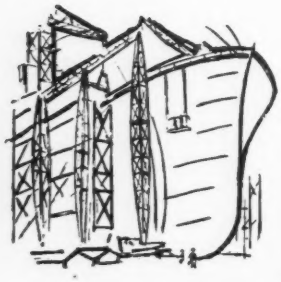
STRENLITE*

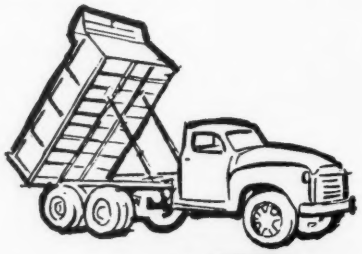
*** STELCOLOY—*High-Tensile Low Alloy!***

- High strength-to-weight ratio.
- High impact properties at low service temperatures.
- Twice the atmospheric corrosion resistance of copper-bearing steel.
- Four to six times the resistance of mild steel to atmospheric corrosion.
- Can be readily cold formed.
- Good welding properties.
- Provides excellent adherence for paint.

*** STRENLITE—*Strong Yet Light!***

- Saves weight without sacrificing strength.
- Equals copper-bearing steel in corrosion resistance.
- Highly resistant to abrasion.
- Suited to bolted or riveted assemblies.
- Can be successfully welded with mild steel electrodes.
- May be formed cold up to ½" in thickness.





Both **"STELCOLOY"** and **"STRENLITE"** are available in plate, hot and cold rolled sheets, coils and slit strip, bars, angles, and hot rolled rods.

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#1 RECTIFIER FAILURE
EVAPORATOR FEED TANK OVERFLOW
RECYCLE BRINE TANK OVERFLOW
440 V. POWER FAILURE
OVERCURRENT #1 RECTIFIER
35 PSI COMPRESSED AIR FAILURE
VENTILATOR FAN. FAILURE #1 CELL LINE
CATHODIC PROTECTION RECTIFIER FAILURE

TO PROVIDE MAXIMUM ADAPTABILITY... Edwards introduces their versatile 'modular' lamp annunciators

Detection of any abnormal condition or change of status . . . visual and audible indication of the trouble . . . automatic starting or shutting down of machinery to correct the difficulty . . . feeding of information to data logging or other control equipment . . . and, finally, resetting themselves, ready to perform again. These are the functions performed with accuracy and precision by the *new* line of lamp annunciators from Edwards of Canada Limited.

For versatility, adaptability in changing applications and simplified servicing the new units feature a unique modular design—complete circuits with data logging contacts *plug-in* to the master panel. Both snap-in indicator plates and snap-fit one piece molded lamp compartments can be removed or replaced without tools.

Possible applications, as diversified as Canadian industry itself, include supervision of machines and equipment in process and automation systems in power plants, substations, oil refineries, industrial plants and even public buildings.

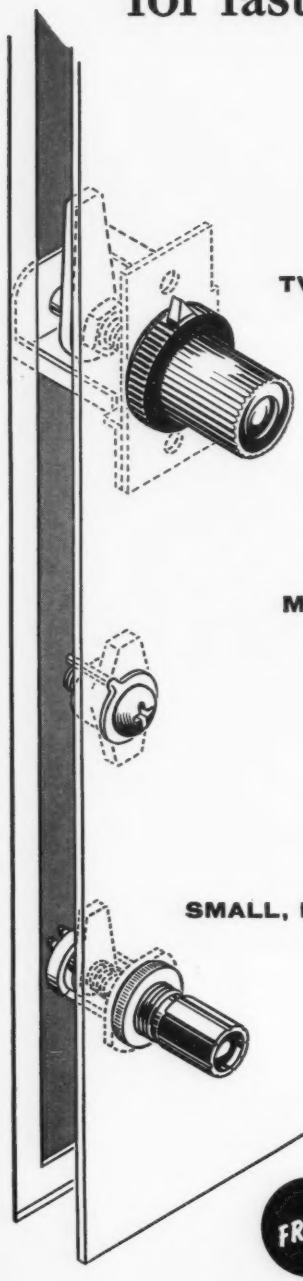
For full information on this new line of Edwards Annunciators, write Edwards of Canada Limited, Owen Sound, Ontario, or any Canadian branch office.

EDWARDS

6106

For further information mark No. 120 on Readers' Service Card

Standards with unique features for fastening doors and panels

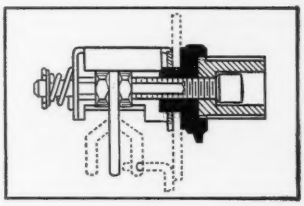


Southco adjustable pawl fasteners are easy and economical to install, give a "class" appearance to equipment. They apply controlled pressure to seal tightly and stop rattles.

TWIN KNOB CONTROL—NO. 46

The pawl engages the frame when the actuator is turned 90°. A bright chrome button in the center of the knob is preset for the amount of pressure to be exerted by the fastener. After the pawl engages the frame, the knob is turned until the button is flush with the knob surface. Preset pressure is thus obtained.

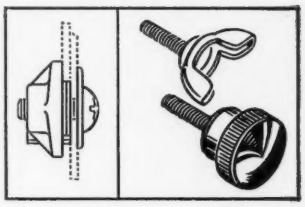
Materials *Body: Cadmium plated steel*
Knob: Black nylon



MINIATURE ENVELOPE—NO. 45

Requiring a minimum of space inside and outside, this fastener latches on a 1/4 turn and additional turning pulls up the door or panel against its frame. The nylon pawl operates smoothly against metal and provides exceptional wearing qualities.

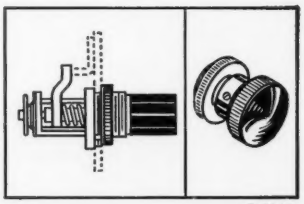
Materials *Pawl stop and washers: Carbon steel, cadmium plated*
Pawl: Nylon, natural



SMALL, HEAVY-DUTY MOUNTING—NO. 48

Small, rugged, compact. One quarter turn closes, additional turning tightens. Quickly installed with a single mounting nut. Three sizes cover every frame thickness from .000 to .750. Can be supplied with flatted shaft for your knob.

Materials *Body and pawl: Steel, cadmium plated*
Knob: Black nylon



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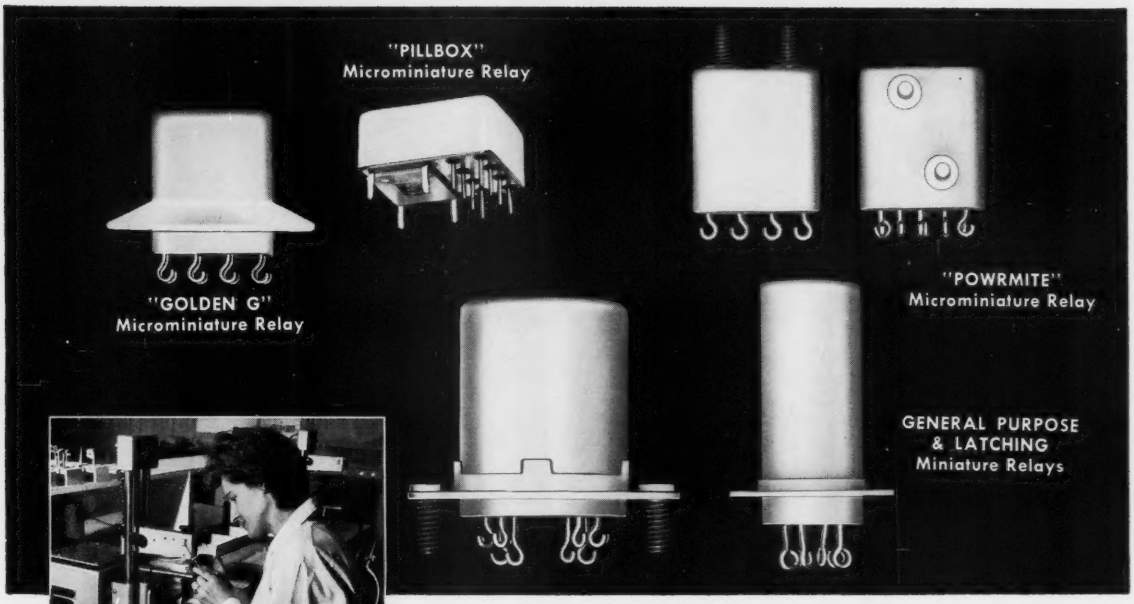

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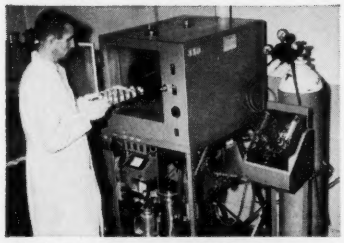

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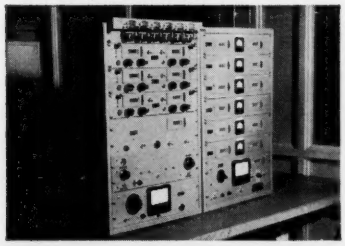

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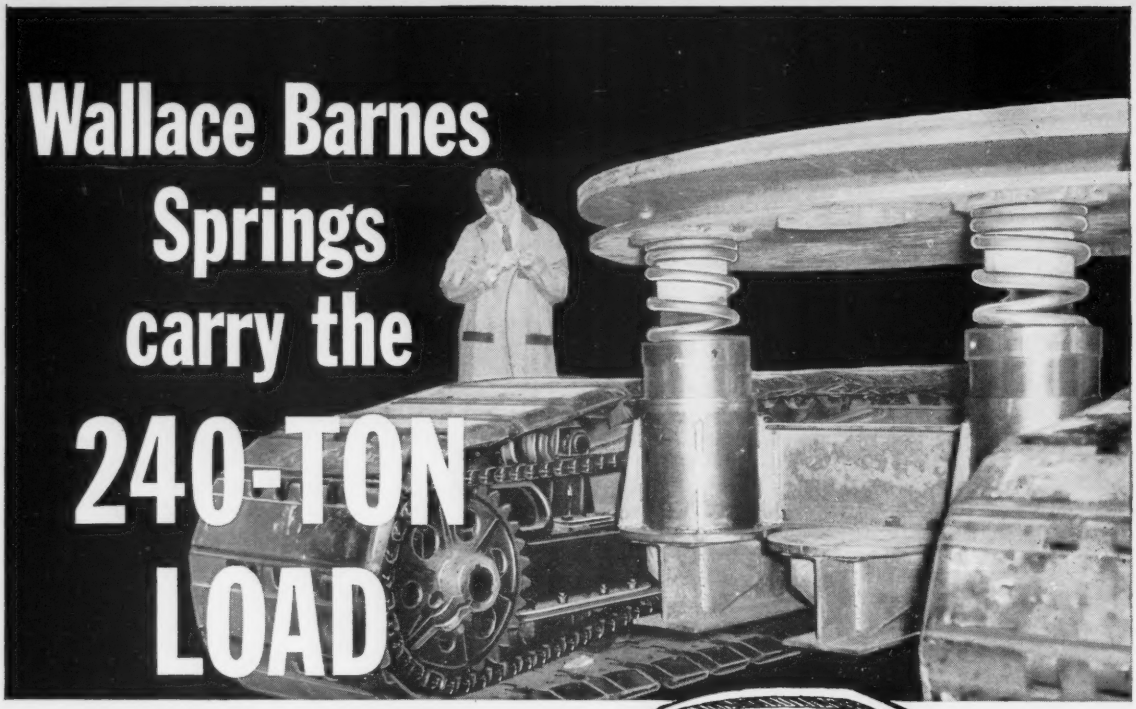

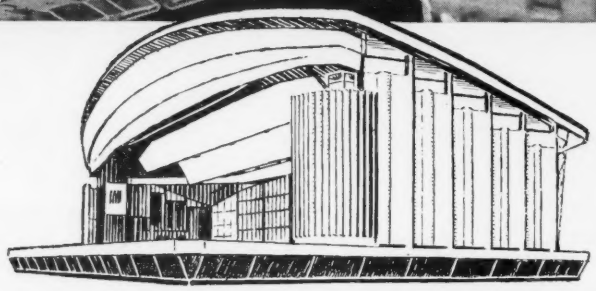

The Canadian National Exhibition was faced with the problem of providing football facilities for the Toronto Argonauts immediately before and after the annual Grandstand Show, without the week-long delay of building and dismantling the stage.

Would a movable stage solve the problem? (The stage is 160 ft. long, 80 ft. wide, 40 ft. high, and weighs 240 tons!)

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MOVING STAGE "FLOATS" ON SPRINGS

To protect complex lighting equipment and elaborate mechanisms, giant springs were designed to support the 240 ton load while being moved. Wallace Barnes constructed huge, 90 lb. hot wound compression springs to cushion the stage during the 400 ft., 5 minute move. 44 of these springs were required to distribute the load throughout the 12,800 sq. ft. base. Trial runs proved that the stage could be moved smoothly without undue jarring or stress.

This is the first stage of its kind in the world and CNE officials are confident that it will pay its way by allowing football and other field activities to take place immediately before and after the annual 3-week Grandstand Show.

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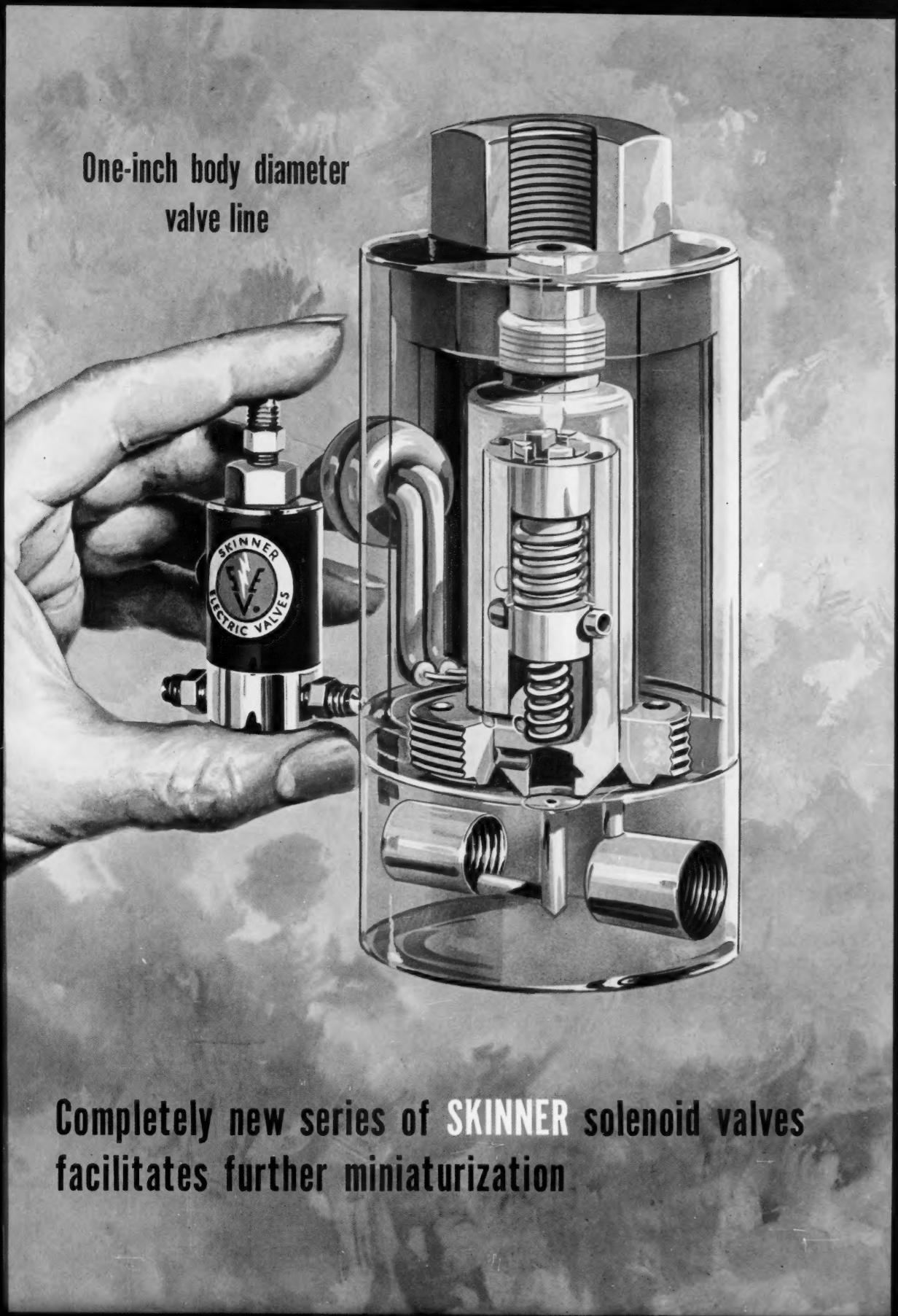
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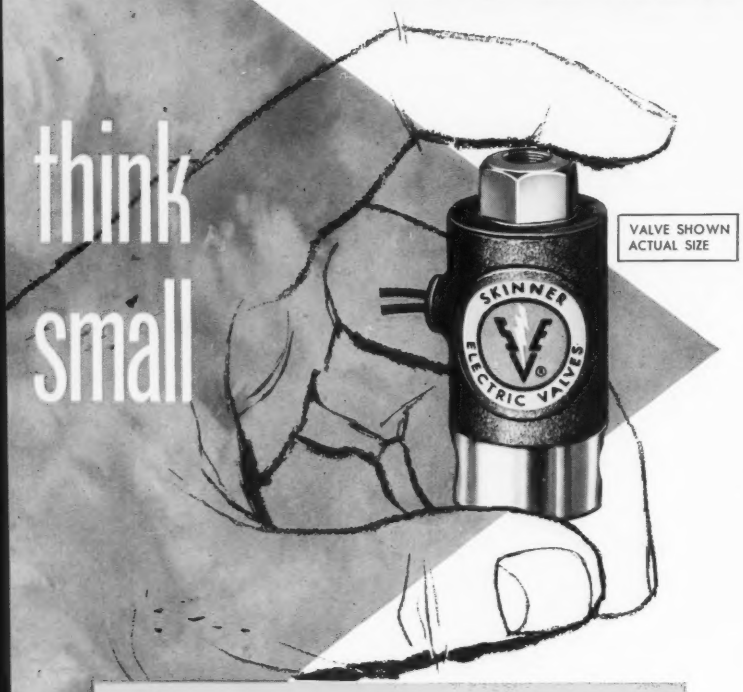

- Now designers of pneumatic and hydraulic control systems and devices requiring high flow in smaller packages can **specify miniature solenoid valves from shelf stock.**
- These new B Series valves are so small and so new that ⅛" NPT was too large, therefore 1/16" PTF connections were selected. Fittings are included to make fluid connections with ⅛" tubing.
- Never before have there been valves like this—**really miniature in over-all size, pipe size, and weight.**

VITAL STATISTICS

Type	3-way normally closed
Over-all size	1" x 2 1/16"
Orifice size	3/64" Inlet and Outlet
C_V factor	.045
Fluid connections	1/16" PTF (adapted for ⅛" tubing)
Weight	5 oz.
Maximum operating pressure	150 PSI
Vacuum	Down to 5 microns

Skinner Distributors are now stocking the first of these new valves—the three-way normally closed. Three-way normally open and directional control, two-way normally open and normally closed, and higher pressure models will be on the market soon.

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No leakage—Soft, synthetic inserts provide bubbletight sealing. Seats have smooth rounded edges—no cutting of insert material.

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Voltage—Coils available in most AC and DC voltages. Heat rise meets U.L. standard of 85°C maximum for continuous duty. Maximum power requirement—7 watts.

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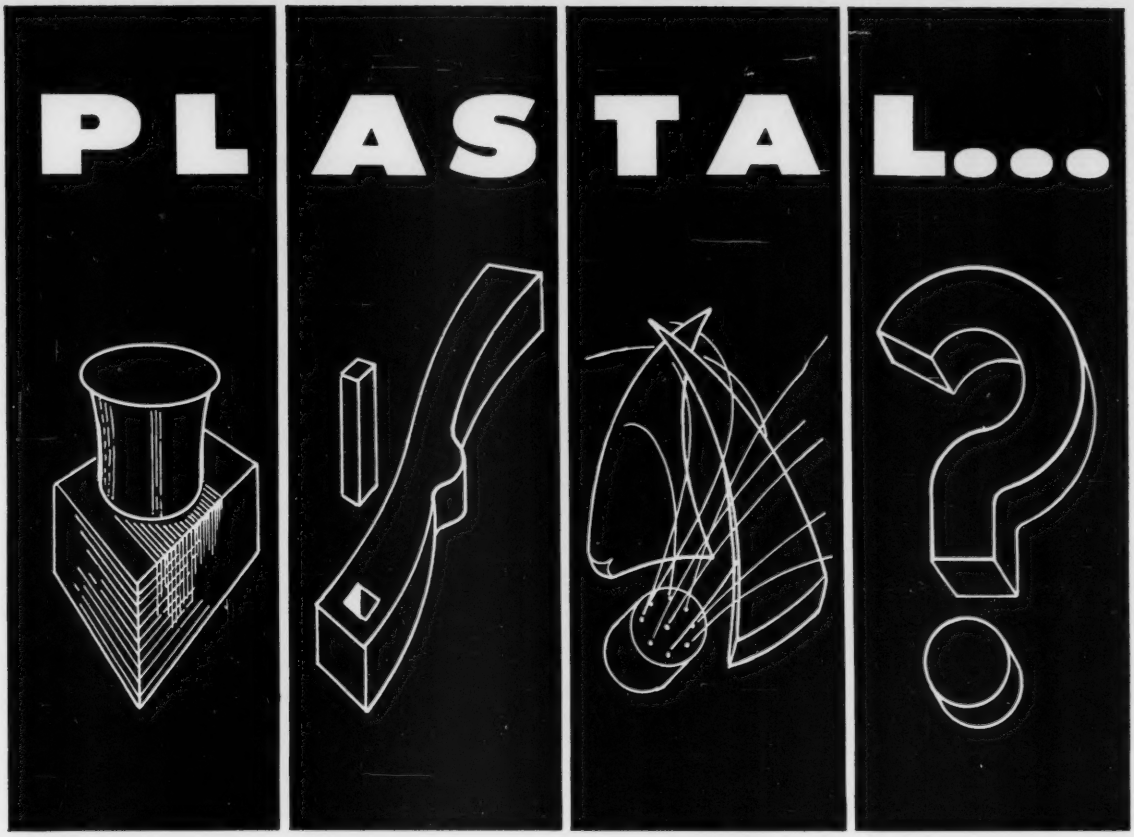

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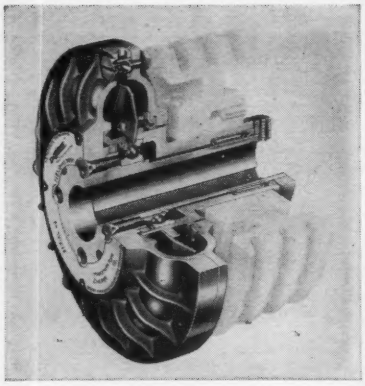
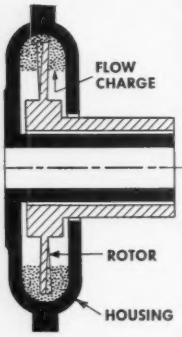
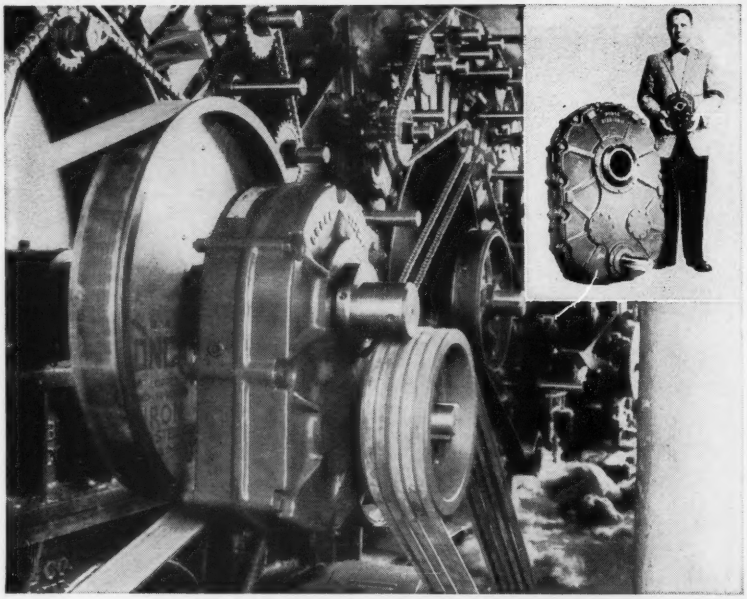
PRODUCT NEWS

FROM UNITED STEEL CORPORATION



FLEXIDYNE "Dry Fluid" Drives and Couplings provide a new way to: start loads smoothly, protect against overloads; reduce maintenance; save on motors and controls. The "fluid" in Flexidyne is heat treated steel shot. A measured amount, called the flow charge, is contained in the housing, which is keyed to the motor shaft. When the motor is started centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor which transmits power to the load. After the starting period of slippage between housing and rotor the two become locked together and achieve full load speed, operating without slip and with 100% efficiency. The Dodge Flexidyne Drive is available to handle from ¼ HP. to over 800 HP. **No. 6801.**





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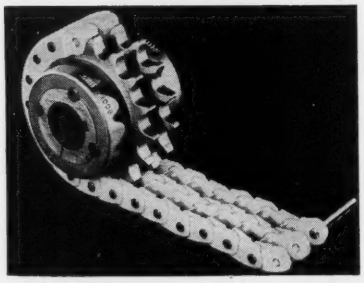

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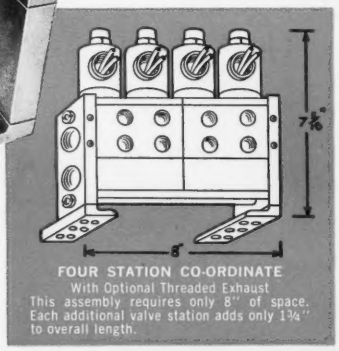

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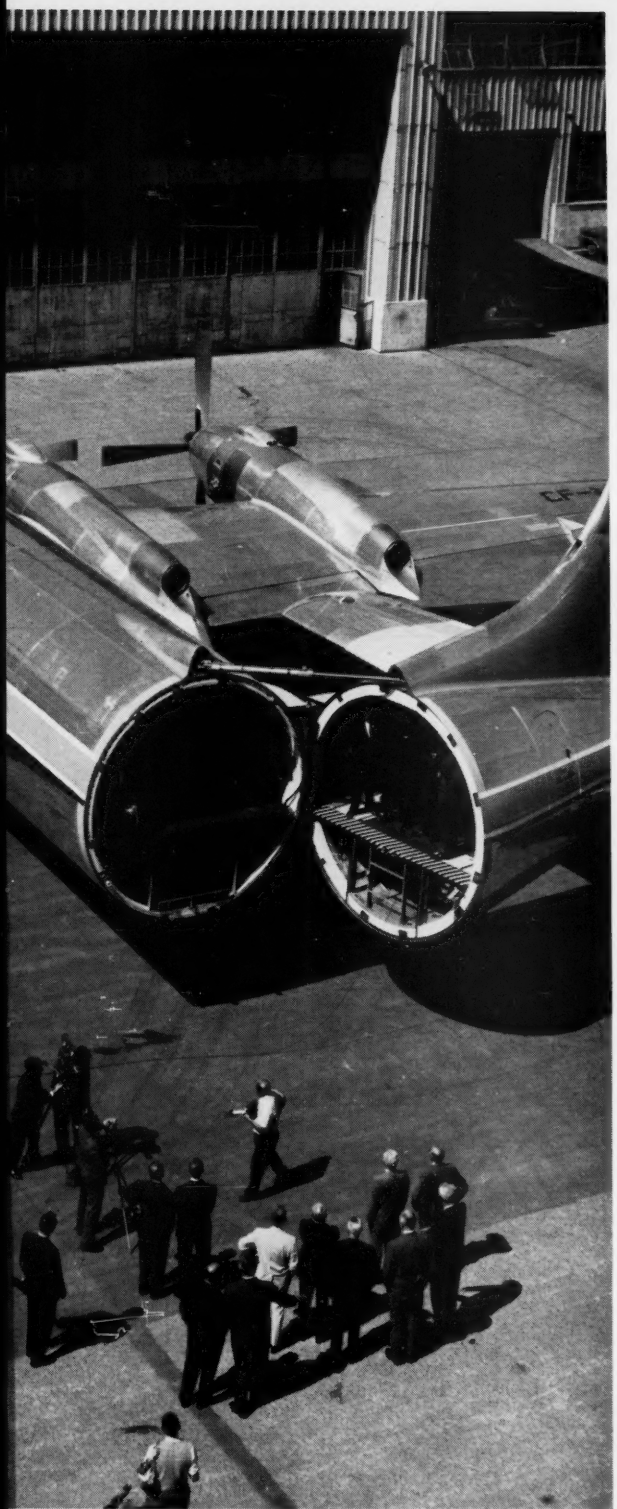
Fluid power solves unique problem in aircraft design

F. N. Newell, chief mechanical designer for Canadair Ltd., explains the operation of the swing-tail



The swing-tail attracted the interest of newsmen at its first public appearance. Initial delivery was made to a US airline a few weeks ago.

Applications of fluid power in the aviation field could be described as legion. It has been said that the modern supersonic aircraft would never have been developed had not the everyday concept of fluid power been generated. From the ups and downs of the undercarriage, through the power boost given to the pilot's movements of the stick, and to the all-important adjustments of the aerodynamic control surfaces . . . through all of these fluid power plays a very vital part.

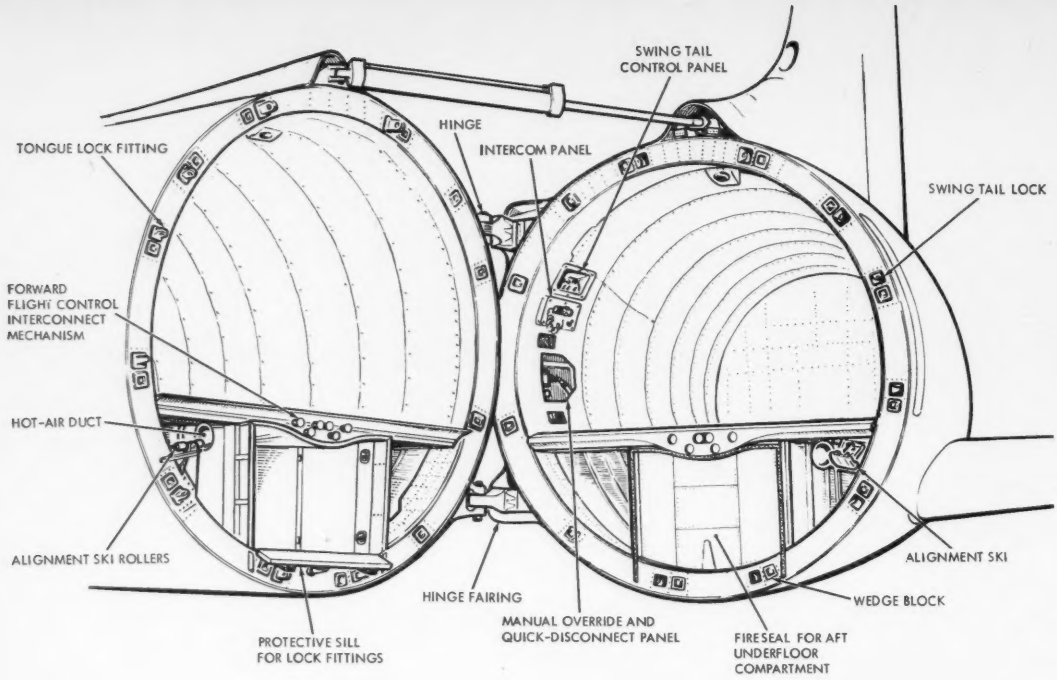
Probably the most unique application of fluid power in recent years in the design of aircraft has been its use in the swing-tail arrangement of Canadair's CL-44. The concept of this commercial cargo aircraft, in which freight may be directly loaded into the cargo compartments by swinging the fuselage tail-end open, produced some varied and interesting problems.

Main hydraulic system

The aircraft's main hydraulic system is of the closed-centre type operating at 3,000 psi generated by two Vickers constant delivery pumps driven by constant speed units on engines 1 and 2. A solenoid-operated unloading valve is fitted between the pressure and return manifolds to permit depressurizing the system in flight when hydraulic services are not required, thus improving the life characteristics of the system. In addition, a hand pump is provided for emergency use.

However, it was considered convenient from the operational point of view to provide an additional method of supplying hydraulic pressure for the swing-tail actuation. Therefore, an electrical motor-pump unit was added which can, in an emergency, be used as an alternate supply of pressure to operate essential services. This pump has a capacity of 4 USGPM at 3,000 psi and is connected into the main hydraulic system. Thus, the tail-actuation hydraulics became a subsystem of the main hydraulic power circuit.

The fuselage swing-tail of the Canadair Forty-Four is opened and closed by two double-acting hydraulic



actuators coupled in tandem, located in the dorsal fin. The forward unit of this pair incorporates two ball-type internal locks which lock the actuator at each end of its stroke, while the aft actuator has one internal lock which engages when the actuator is fully extended. The locks are automatically released when a reverse selection is made. The cylinder of the forward actuator is secured to the fuselage structure while the piston rod is pin-connected to the aft actuator piston-rod. This piston-rod connection is supported in a crosshead-type slider operating in two guide rails attached to the fuselage tail structure. The cylinder end of the aft actuator is connected to the structure of the vertical stabilizer with access to the actuators being provided by panels in the dorsal fin structure.

The latchpin actuators are double-acting units, each incorporating a mechanical lock which engages the piston rod in the extended position. This lock prevents any movement of the latchpin from the engaged position, unless a positive predetermined pressure is applied to the retract side of the actuator. Two microswitches are installed at each latch position, operated by the latchpin, one at each end of the actuator stroke. The microswitches at the extended end of the actuators are in series and connected to the swing-tail "Not Locked" warning circuit, while those at the retract end of the stroke are connected into the main actuator selector-valve circuit. The latches are carried in fork fittings attached to the tail fuselage structure and are arranged to match tongue fittings located on the rear frame of the main fuselage. (See figure above.)

Selector valve is electrical

The flow of hydraulic fluid to the two main actuators is controlled by an electrically operated selector valve with a similar valve controlling the operation of the eight latchpin actuators. The actuator ports of the main actuator-selector valve are closed when the valve is in the neutral (de-energized) position while at the same time the actuator ports of the latchpin-selector valve are connected to return. Electrical and mechanical sequencing is employed between each of the main actuators and the latchpin actuator circuit. The latchpin actuators are not individually sequenced, since the random latching resulting ensures that the latchpin with the lightest engagement load will operate first and by its local "buttoning up" action provides easier engagement for the adjacent latches.

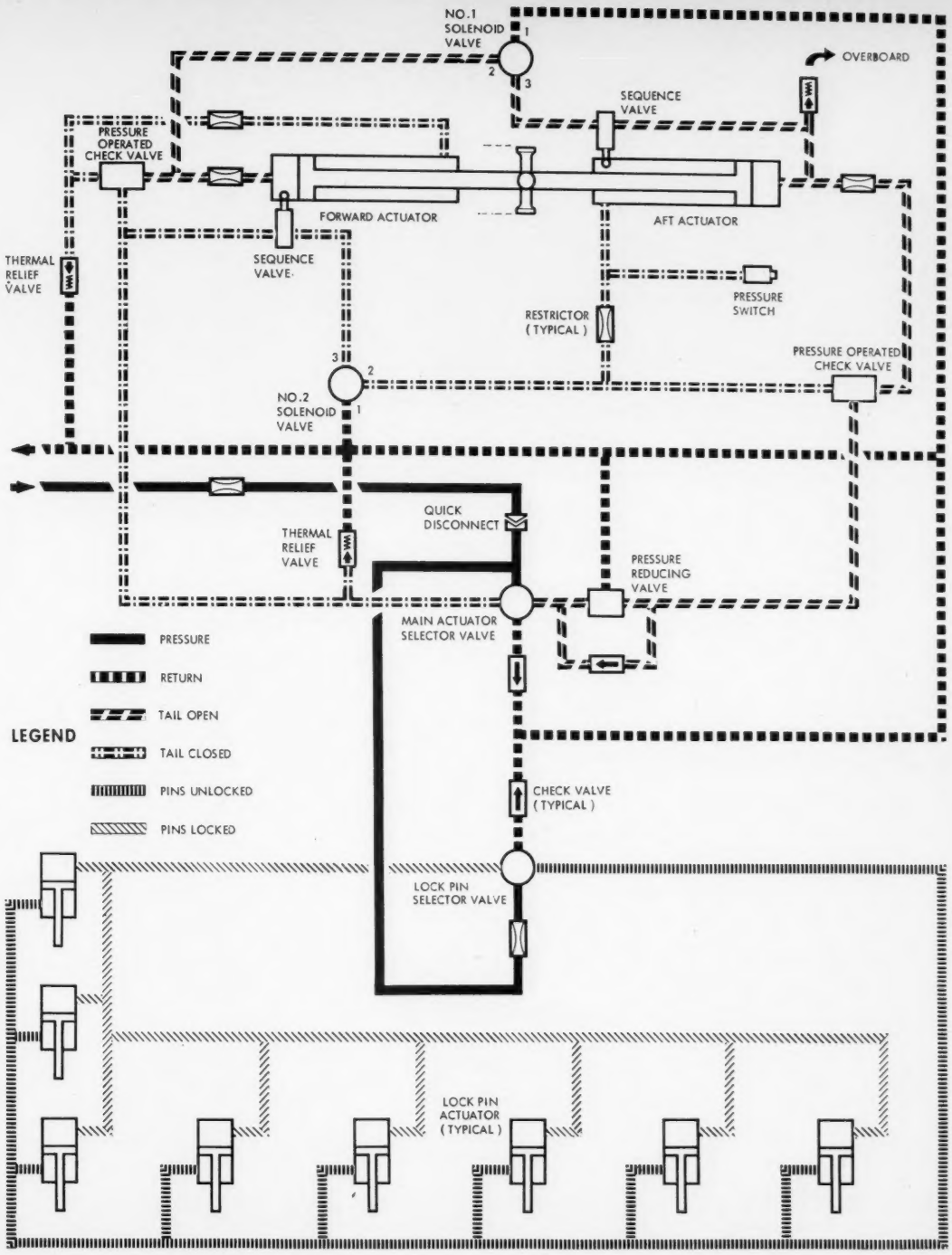
It was found that the unlatching sequence is not the reverse of this random pattern. This is due to the fact that when the "buttoning-up" process occurs, the male and female torsional shear-wedges located at the joint faces of the frames at the fuselage break tend to hold the tail by friction, therefore the problem of the last latch out being heavily shear-loaded is minimized.

Mock-up for testing

When the preliminary design was completed, it was decided that a full-scale functional mock-up should be built. Therefore, approximately 10 feet of representative structure for each side of the swing-tail joint was built and suitably mounted so that the effect of wind speed and cargo load in the tail portion could be studied. As a result of operational experience with this specimen, certain development-type changes were made, but the main design remained unchanged and successfully completed a number of cycles of operation more than sufficient for the life of the aircraft.

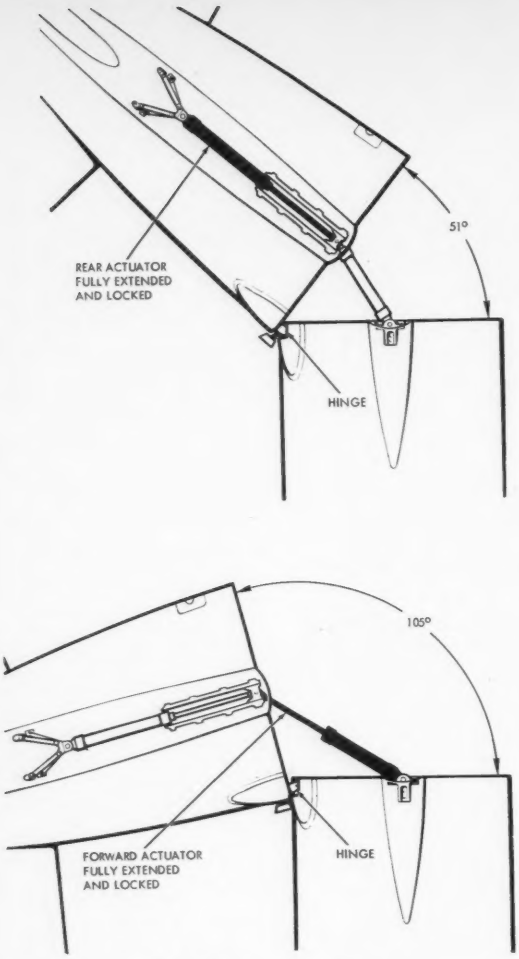
This functional mock-up also served as an admirable demonstration piece to convince visitors to Canadair that swinging the tail of such a large aircraft was a very practical way of loading cargo, and that the hydraulic actuation would give good, trouble-free service.

The control panel is located on the right-hand side of the fuselage just aft of the break, and contains the necessary switches and indicator lights which are paralleled with warning lights on the pilot's annunciator panel in the cockpit.



Schematic of the swing-tail hydraulic system.

Before the tail can be operated, the quick-disconnect coupling at the control position must be connected. When the control switch is selected to OPEN, electrical power is directed to release pneumatic pressure from the fuselage joint seal and to select the main actuator selector valve to the CLOSE position. This directs hydraulic pressure to the close side of the main actuators to relieve the shear loads from the latchpins. When the pressure at the aft main actuator reaches 2,500 psi, a hydraulic pressure switch in the circuit energizes the latchpin selector valve to allow hydraulic pressure to withdraw the pins. Once selected, a holding relay main-



The use of two cylinders in series provides different sized openings for the loading and discharging of air freight.

tains the selector valve in the withdrawal position, regardless of pressure fluctuations, until the tail is open.

Completion of latchpin withdrawal reverses the selection of the main actuator selector valve through the latchpin microswitch and a relay. The selector valve then directs hydraulic pressure through a pressure-reducing valve and, in the free-flow direction, through a pressure-operated check valve to extend the aft actuator and open the tail approximately 51 deg.. On reaching the end of its stroke, the aft actuator internal lock is engaged which, in turn, opens the sequence valve. At the same time, the microswitch on the crosshead rails is actuated to de-energize number 1 solenoid valve. This directs the pressure from the sequence valve to the extension port of the forward actuator and also to the operating port of the forward actuator pressure-operated check valve.

Pressure disengages actuator

This pressure disengages the forward actuator internal lock and opens the pressure-operated check valve to permit the forward actuator to extend and open the tail the full 105 deg. When the forward actuator is locked in the extended position the microswitch in the actuator, through a relay, switches on the OPEN and LOCKED light on the control panel. The control switch can then be released and the pump switched off.

Placing the control switch to CLOSE switches off the OPEN and LOCKED light and energizes the main actuator selector valve to the close position. This directs hydraulic pressure to the retract port of the forward actuator through the pressure-operated check valve in the free-flow direction, the return fluid passing through the energized number 2 solenoid valve to return. This releases the forward acuator internal lock and retracts the actuator to lock it in the retracted position.

As the lock in the forward actuator is engaged, the sequence valve is opened to direct pressure fluid to the number 1 solenoid valve which is de-energized at the same time to complete the circuit to unlock and retract the aft actuator. When the tail is fully closed, a microswitch on the structure reverses the latchpin selector-valve selection to extend the latchpin actuators and insert the pins. This same circuit de-energizes the seal control-valve to pressurize the seal.

With all the latchpins fully engaged and the quick-disconnect coupling correctly stowed, the amber OPEN light on the control panel and annunciator lights are out. A visual check of the latchpins can be made through cutouts provided in the interior trim and structure. An access door in the cabin floor and a walkway in the tail underfloor area facilitates checking and servicing of the lowest latchpins. ★

CL-44's with the swing-tail will ferry freight for the major all-cargo airlines in the United States. Note the swing-tail hinges in the picture below.

For the simplest control system..use check valves

Choosing the right valve for one of the many fluid power applications is simplified by John J. Pippenger, vice-president, Double A Products Co.

Fluid power systems can squeeze steel through an extrusion die or gently nudge a damping rod into a nuclear reactor. They direct fire-control on ships and planes, bore cylinder blocks, lift elevators, apply brakes, and forge tools. And it is valves that make this wide range of applications possible.

Without valves our fluid power circuits would be useless. Today the designer of a fluid power circuit is faced with the problem of choosing from among hundreds of different valves to perform thousands of specific functions. But such versatility creates its own problems. The designer is being called upon to know more and more . . . and not the least of the subjects requiring attention is valves.

Take for instance, the so-called common check valve. Which one is best? Which one should you use? What do you really know about them?

A check valve has been defined as: "A valve which permits flow in one direction only and self-closes to prevent any flow in the opposite direction."

In its simplest form

In its simplest form this valve consists of a drilled inlet port that is closed off by a spring or gravity held ball. Flow to the inlet port lifts the ball off its seat, and oil flows freely to the outlet port. Reverse pressure forces the ball against the seat and closes off the flow.

The primary disadvantage of a ball element is a poor wear characteristic. If the ball always seats in the same position, it can be expected to seal satisfactorily. If it reseats in the one position often enough to wear a groove at the seal line, any later rotation of the ball will ruin the seal. For this reason balls are often guided or poppets are substituted. The poppet design always maintains the same relationship with its seat.

If the ball or the poppet is not spring-loaded, the valve must be installed so that gravity will guide the moving element to its seat. For lower-pressure ranges it is common to design a hinged flapper that swings against a seat when pressure and flow are reversed through the valve. Flapper units rarely have a spring closing device, so the valve position at installation is important. Spring-loaded checks may usually be installed in any position.

There are many places where an in-line check valve can be used to advantage and a savings in original cost can be effected without interfering with maintenance procedures. However, if an elbow is needed in a line that contains a check valve, then an angle check may be less expensive than the in-line model and two connections are eliminated. This valve offers easy access to its internal working parts. The cap may be drilled and tapped for an additional connection as a source of pilot pressure. The tap also makes a good gauge connection for the circuit, or a small bleeder valve may be inserted to remove entrapped air at high points.

Ready access to the interior of this valve makes it an ideal vantage point to check fluid condition. Often it is easier to remove the poppet and inspect for varnish deposits or other indications of fluid deterioration at this point than at any other place in the circuit.

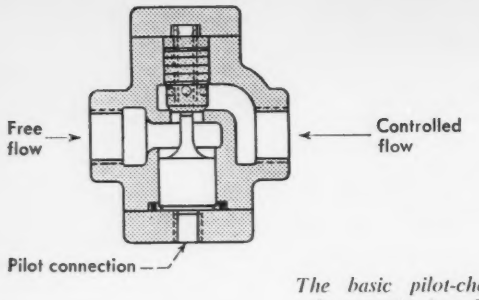
Excessively high spring loads are to be avoided in check valves. If the valve closes and opens too quickly, hydraulic shock waves are created, and even small shocks may set up harmonic vibrations with other machine members, causing undesirable noise and chatter.

Check-valve poppets may be drilled to take an orifice plug. These are often used in small industrial elevator circuits and in tilting mechanisms as a safety control. The elevator, for example, will rise at a speed dependent on the flow to the lift cylinder. The gravity return, however, may be much faster if there is no restriction in the line to the tank. To limit return speed the orifice check valve is placed in the cylinder line so as to permit free flow on the upstroke and controlled flow on the return.

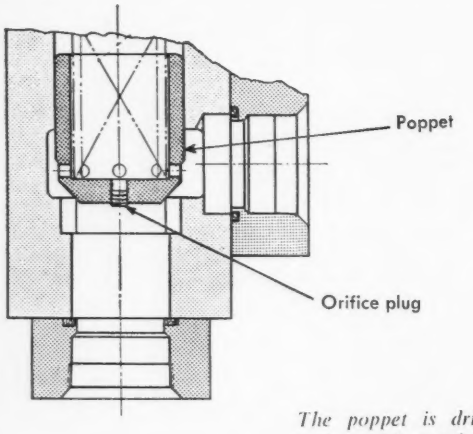
Pilot operated checks

The simplest type of pilot - operated check combines a poppet with a simple piston which will unseat the poppet when pilot pressure is applied. To lift the piston, pilot pressure times pilot-piston area must be somewhat greater than contained pressure times poppet-seating area. Force of the light spring tending to hold the poppet closed must also be overcome by pilot pressure. The ratio of piston area to check-seat area varies in different models.

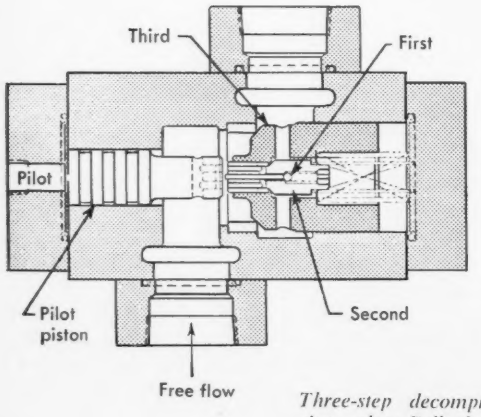
Most single-acting pilot-check valves are abrupt in opening and throttling is limited. If throttling is required, some other type of valve should be used.



The basic pilot-check valve permits free flow in one direction. Flow is completely stopped in opposite direction.



The poppet is drilled and tapped to take an orifice plug. Forward flow is free, and return goes through restriction.



Three-step decompression valve. Ball check, second poppet, then entire poppet are lifted. Reverse flow is free.

Adequate pilot pressure must be maintained on the pilot of the check to guarantee that it is held open. A check valve piloted from a line in which the pressure varies with the load will flutter, setting up detrimental shock waves. When the pilot-operated check is used to hold a load on a vertical cylinder, it is common to take the pilot source from a point in series with a sequence valve so that this necessary source of pilot pressure is maintained.

In many machines the pressure never rises any higher than the force required to move the work. A good example of this type of circuit would be a broaching machine in which the cutting force is directly proportional to the type of metal being machined, the sharpness of the tools, and the amount of metal being removed. As the tools become worn, higher forces are required to push or pull the cutters through the work. Maximum pressures on machines of this type are usually based on maximum possible loading that can be tolerated by the mechanical design.

Sudden decompression of such systems may damage or wear circuit components. When abrupt action is undesirable, controlled pilot-check action can assist in decompression. A ball or small piston is first unseated by the pilot piston. A portion of the oil under pressure is released through a small orifice at high velocity to lower the contained pressure to a secondary value. The main poppet then releases at a reduced shock rating. By first releasing oil through a relatively small orifice at high velocities, movement of the load mass is slowed until all stresses are diminished.

The two-step decompression cycle is adequate for the average machine-tool application. Note that the manifold mounting should reduce all stresses at the poppet area—important in machine tool operations in which fine-feed mechanisms may be controlled by the pilot-check valve.

In larger press applications it is often desirable to incorporate a three-step decompression cycle. Three-step decompression checks are made in two basic series. The standard type is manufactured with a pilot piston whose area is smaller than the effective area of the poppet. A molding-press circuit might incorporate a simple ram-type cylinder for application of pressure against the closed platens. The press is opened and closed with one or more jack rams or cylinders. As the jack rams close the press, the main ram is filled through a check valve by atmospheric pressure. If atmospheric pressure is inadequate to open a normal spring-loaded poppet with the relatively high spring pressure needed by large poppets, it may be desirable to hold the poppet open with pilot pressure. After the press has closed, fluid under pressure is diverted into the main ram to build up the desired tonnage on the platens. At this time pilot pressure is released on the check valve so that it closes. If additional prefill checks are used, they may operate automatically by the cessation of movement of the ram.

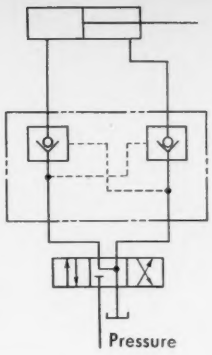
Large pilot pistons

A pilot-check valve may be equipped with a pilot piston having greater area than the main poppet. In this unit the decompression factor may be less important than the function of opening flow in a relatively smooth manner. Units with a large pilot piston are intended to open against a continuing flow of fluid wherein the opening of the pilot check will only momentarily lower the pressure value.

Many civil-engineering installations, such as flood gates and other power-control devices, use this type of

pilot-operated check valve to hold units that may not move more than two or three times a year or possibly only in an emergency that happens once in several years.

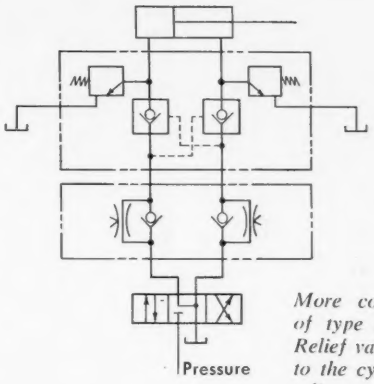
In some installations pilot-operated check valves are placed in pairs in a common housing with each pilot line coming from the free-flow side of the opposing check. These check valves are used in cylinder lines. When flow to the check valve is stopped, pilot pressure is relaxed and the checks lock the cylinder in position. The directional-control valve is of the three-position centring type with pressure blocked in neutral and the cylinder lines relaxed to the reservoir. This compound unit of dual checks is sometimes built into a package manifolded between a mounting plate and the body of the directional-control valve.



Pair of pilot operated checks with pilot lines crossed lock cylinder in position until directional valve shifts.

Fine feed control

Circuits have been developed in which pilot-operated check valves are the key to precise control of machine movements. For the small flows in some feed circuits, directional-control function is taken over by several pilot-operated check valves. The check valves are controlled by conventional piloted four-way or three-way valves. The check valve either blocks direct flow of fluid from the cylinder for stopped position or opens to a desired orifice to permit uncompensated feed. A second pilot-operated check is teed between the blocking pilot-operated check and the cylinder and can be opened back to the reservoir to permit a rapid traverse when needed. This permits fine-feed rates when load and pressure are uniform and a compensating factor is not essential.

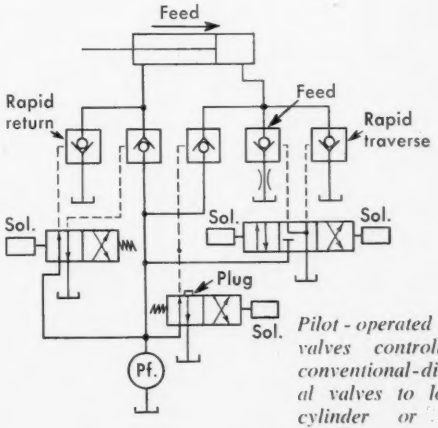


More complex circuit of type shown above. Relief valves are added to the cylinder lines to relieve pressure when heated.

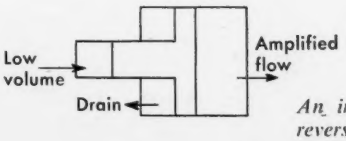
Another method of providing an extremely fine feed is to use an intensifier in reverse. This is then an amplifier of volume rather than an intensifier of pressure. With the assistance of pilot-operated checks to channel the fluids in the proper manner, meter-out oil from the cylinder would be directed to the small-diameter piston in the intensifier. The piston lap is usually of sufficient length so that sealing is adequate. Oil from the large-diameter piston would be directed through an orifice (either compensated or uncompensated) at a much greater rate than the entering fluid. The quantity of oil to be controlled would be a function of the length of feed required. The degree of control would determine the amount of amplification.

Note that a limited stroke is involved and that an amplifier must be chosen of sufficient size to handle maximum length of feed. In addition, circuit operation must permit resetting the amplifier to its starting position before further feeds are attempted.

A feed circuit may make use of an amplifier system. The pilot-operated check valve is held open for rapid traverse. The head end of the cylinder is used for the meter-out part of the feed. This permits maximum use of the available area during the feed operation. When the pilot check is closed, fluid from the head end is diverted to the small end of the amplifier. Fluid from the large side of the amplifier passes through the feed-control valve and to the tank. When the directional-control valve is reversed, fluid passes freely through the unpiloted-check valve in the cylinder line. This check valve sets up a sufficient pressure drop to make certain the amplifier is recharged for the next cycle. A coarse feed can be introduced with a second line teed off the head end of the cylinder through a second pilot check to a flow-control valve. However, direct flow control is usually adequate for the coarse feed. ★



Pilot-operated check valves controlled by conventional-directional valves to lock the cylinder or control feeds.



An intensifier used in reverse will increase flow volume, making metering a simpler problem.

Air power makes smaller firms competitive

It is no longer necessary to build special integral controls for each individual machine application. An interchangeable unit solves the problem. Irwin Walle of Holman Bros. (Canada) explains how universal air control can help the small operator beat big competition.

The author shows DE's editor how a sequence for controlling nine cylinders can be set up at the central pilot control.

Building versatility into our industrial operations in order to compete with other countries that enjoy high production runs, has long been one of the special accomplishments of Canadian engineers and designers. A single facility that can be readily adapted to any one of a variety of operations often is the best, and sometimes the only, solution to the problem of obtaining versatility. Such a facility is described below.

Per capita, Canada uses more air power than any other country in the world. And the major users in Canada are not the larger companies that receive their engineering guidance and ideas from abroad, but rather the smaller manufacturers whose livelihood depends on their ability to compete with the overflow production from the expensive and highly productive machinery.

For this reason the air circuit, or rather control by air, has been developed in Canada to a much greater degree than in other countries. This is a natural phenomenon, since air is often considered not very satisfactory for the transmission of power where the more expensive electro-hydraulic methods of control can be easily justified on large production machinery.

Consequently the advantages of an air control system, even when applied to hydraulics, has escaped attention elsewhere. This has permitted the Canadian manufacturer, by the ingenious employment of such systems, to build production machinery at a fraction of the cost to foreign competitors. In fact, Canadians are already exporting many such products. It is also worth noting that the majority of machinery exported by Canada is air operated.

Progress is slow

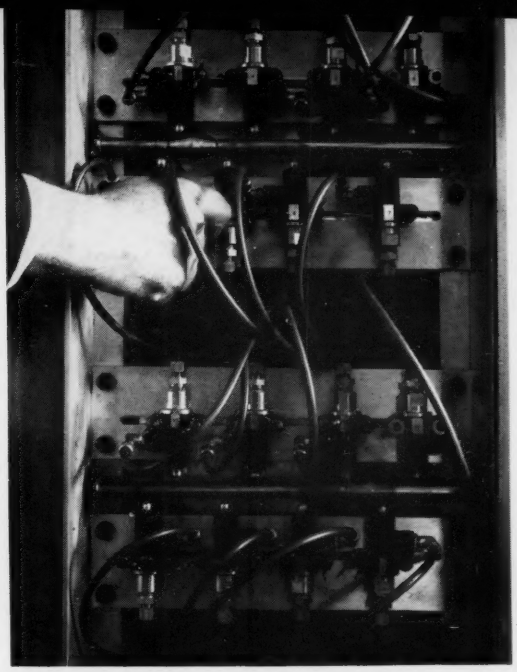
In spite of this, air control has not progressed anywhere in keeping with its potential. This is partly due to the tremendous interest centered on electronics during the past few years. The time spent in assembly and experimentation with an air circuit can often offset the savings in initial cost and provide some first class headaches as well. Also, even with the cost savings of an air circuit, it is often still too expensive to build a machine purely for the production of one particular part in comparatively small quantities.

These factors have resulted in a tendency for designers of machines with air circuits to "cut corners". When a machine has to be produced at absolute minimum cost, a great deal of responsibility is often placed upon the air equipment used. The accuracy and function of the equipment is relied upon where guides, bearings, stops and other mechanical features would normally be introduced. Yet, in spite of the very important role to be played by the air equipment, the air circuit is invariably the first to suffer under the cost-cutter's axe, especially where one valve can possibly be used to do the work of two or three. While this illustrates the versatility of an air circuit, it is only too often overlooked that every valve cut out of a circuit invites experimentation, and experiments are costly.

To provide an immediate solution to the "short run" production problem then, it is first necessary to provide a method of transmitting power in controlled sequences which can be installed by untrained personnel without any experimentation. Secondly, this system must be inexpensive enough to warrant its use in production runs of a few hours' duration.

These specifications sound very imposing. However, a system of pneumatic controls has been developed which provides a simple answer. This is a prefabricated universal circuit, which can be built by a manufacturer of pneumatic equipment, or by the user himself. The circuit is entirely contained in a box, and this has led to the use of the term "canned."

A chart shows how to connect the jumper lines and control points.



Pilot valves hand-tightened into slots are engaged by two piston-operated cams moving in opposite directions.

The foremost advantage of the canned circuit is that it can be preset by the manufacturer to the desired function and supplied under a guarantee that it will perform that function. This immediately dispenses with designing, installation and experimentation costs. At the same time, being an air circuit, it uses very little equipment other than is normally used in an appropriate circuit and thus effects all the savings occasioned by the use of air.

A universal circuit control

Secondly, being universal, it can be utilized for any application, which means that it can be transferred from one machine to another. This transfer can be effected very rapidly and the equipment be made to accomplish an infinite number of sequences by selection alone.

Therefore, if a series of machines or complex jigs are developed to produce short run components, the individual cost of these machines will be confined to the actual machine parts and the cylinders which move them. The cost of the valves and controlling mechanism, which normally runs to some 50% of the machine's cost, will be spread over the total of all these machines as the one control system will operate any of them individually, and will always be available for further applications.

In the case of high production, where a number of these circuits are in constant use, only one would be required as a replacement in the case of malfunction. Down time would be reduced considerably, as the entire circuit would be replaced, dispensing with the need to immediately discover the offending valve.

Principle is simple

Although the development of the canned control took a considerable time, the actual answer, when broken down, is so simple that it is astonishing that it is not already in general use. It is based on the simplest form of an air circuit, where cylinder A, which when operated, contacts a pilot valve which causes cylinder B to operate.

If cylinder B then contacts another pilot valve to reposition the main control valve, both cylinders will retract.

This circuit is non-adjustable. The pilot valves are located on the machine in a permanent position and are actuated by mechanisms operated by the cylinders. It is, however, completely assured that cylinder B will not operate until cylinder A has achieved the required movement.

If it is required that cylinder B should retract before cylinder A, then the circuit would have to be completely reworked. In this case, another pilot and another control valve have been added to the circuit. Again, the circuit is not adjustable, but it illustrates clearly the advantage of cutting off air to the pilot valves in circuit work.

If a number of cylinders are required to operate in a similar sequence, the resulting piping and number of valves used is considerable. But, if instead of using the working cylinder to activate the pilots, another cylinder is used purely for the purpose, the relative circuits are as shown on the next page.

All lines are direct

While another pilot valve has been added and also the control cylinder, the important factor is that all the lines are direct connections and can be numbered. Also, if the pilot valves are mounted so they can be easily repositioned, then alternative sequences can be set up by adjustment of the pilot valves alone. Thus, if the next operation called for cylinder A to advance and retract, followed by a similar movement of cylinder B, then all that would be necessary would be the re-

positioning of the pilot valves. In addition to this, if cylinder A is required to advance and retract rapidly, while cylinder B has to hold its extended position for a time interval before retracting, then the pilots could be repositioned to accomplish this.

We now have a basic sequence and timing circuit. To make it automatic, the last pilot valve actuated by the cylinder is also used to reposition the main control valve and reverse the control cylinder. When this is done, unless one way trips are used on the pilot valves, they will also give a signal to the valves they control by the reverse stroke of the control cylinder. To counteract this, air is supplied to the pilot valves only during the forward stroke of the control cylinder by taking the supply line from the main control valve, leaving the pilots "dead" during the return stroke so that, although actuated, they are unable to transmit a signal.

Two different cycles

Once this is done, it is an easy matter to set up another bank of valves which are supplied with air only during the reverse stroke of the control cylinder, which doubles the amount of pilot valves actuated by the control cylinder and enables a definite programme to be divided into two completely different cycles.

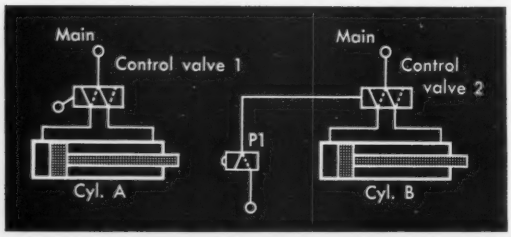
These cycles can be conveniently termed "load" and "unload", mainly to distinguish the movements but also because most machines require these two functions. The two movements can be made at completely different speeds by speed controls on the controlling cylinder, permitting the machine to load slowly and unload quickly, or vice-versa as the operation requires. The two movements can also be combined to give a constant rotating cycle if the "load" and "unload" features are not required.

This forms the basic control mechanism required. It can easily be mounted on a panel or enclosed in a box. The leads from the pilot valves can be taken through a common point and numbered. Thus, if a different sequence is required, it is not necessary to move the pilot valves at all, but by means of easily connected couplings, the changes can be made by interchanging the control points. The pilot valves then need only be moved to govern the time intervals between operations.

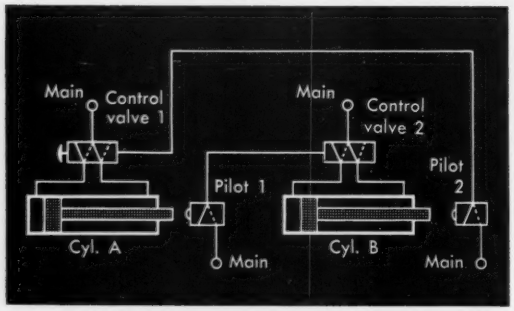
As shown, the circuit is able to give eight completely separate impulses. However, if more impulses are required, it is only necessary to lengthen the stroke of the control cylinder and include more pilot valves.

At this point it is well to note that, in an extremely slow cycle, or one where the control cylinder is passing the cam over the pilot valves very slowly and yet a very fast movement is required by some cylinders, it is necessary to place the two pilot valves controlling the cylinder very close together. The bulk of the pilot valves prohibits this and it therefore becomes advisable to place the pilots on both sides of the cam. To prevent a complexity of lines by this procedure, two control cylinders are used, moving in opposite directions, one controlling the "load" movement and the other the "unload". This also has the advantage of causing both cylinders to activate their pilot valves only during the forward stroke of the cylinder, avoiding any confusion or delays while the directional changeover is made.

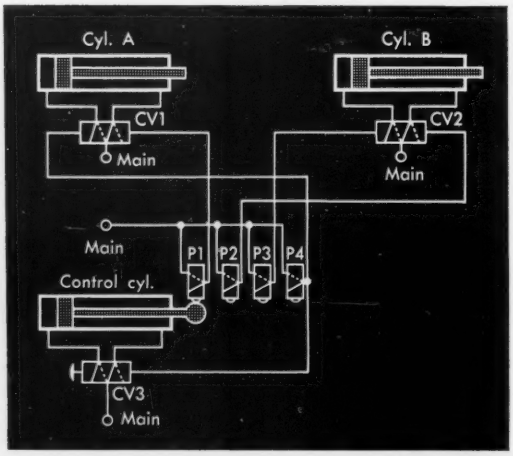
If balanced spool types of control valves are used to receive the signals from the pilots, these valves can in turn be mounted on a panel and numbered to correspond to the cylinder or cylinders they operate. Again, being in a permanent order, the parts can be numbered and changing the panel from one machine to another merely involves the attaching of lines with matching numbers. Therefore, to set up a sequence with this system is a question of matching numbers throughout. It requires no engineering or circuit drawings. ★



Basis of the system is the operation of one cylinder by another, as above.



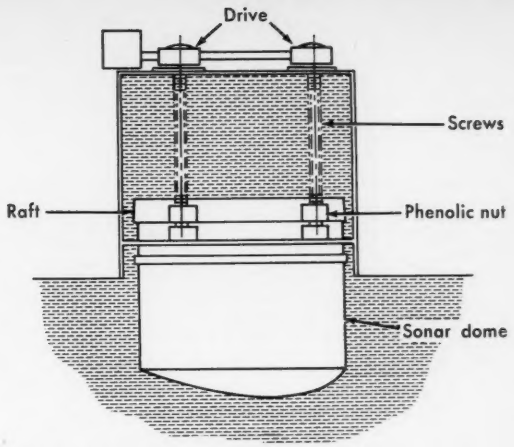
Both cylinders return by means of a second pilot valve operated by a separate cylinder.



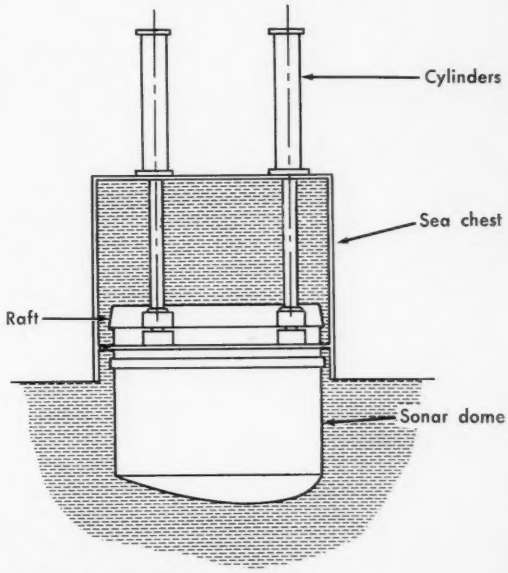
Separate cylinder actuates the pilot valves in the desired sequence and time ratios.

Hydraulics helps locate enemy subs

Bruce French, P.Eng., tells how Vickers-Sperry of Canada Ltd. designed sonar retracting gear for the R.C.N.'s sub chasers



The old system for raising and lowering the sonar gear was mechanically driven. A calcareous deposit formed on the screws damaging the phenolic nuts.



In the revised system four hydraulic cylinders raise and lower the raft and sonar dome. Their level is automatically monitored to prevent jamming.

Fouling problems on marine mechanical equipment can cause unexpected troubles. This was the case in the handling gear for the 7A Sonar device on board the Royal Canadian Navy's "DE" vessels. An apparently sound mechanical device for raising and lowering the sonar gear was operated by four screws. These screws were made of stainless steel and the nuts in the moving part of the equipment were made of a phenolic material. This device, originally designed and installed in the U.K., was not expected to give any troubles in operation. Subsequently, it was found that fouling and a calcareous deposit on the screw was extremely hard on the phenolic nut and required frequent overhaul with expensive dry docking.

Various materials for both the screw and the nut, which are both in the flooded area, were tried without much improvement. The design of the square thread with its resultant sharp corners probably assisted in the plating out of the hard, brittle material.

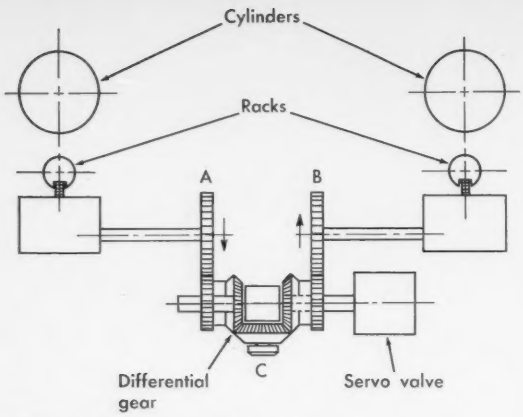
In searching for an answer to this problem, alternative methods of raising and lowering were considered. The success of hydraulic handling gear on other sonar devices had directed attention toward the use of hydraulic cylinders. However, this presented some problems since the central area must be left free for the sonar gear. This precluded the use of either a single central cylinder or the hydromotors used on other raising and lowering gears.

Novel servo-system is solution

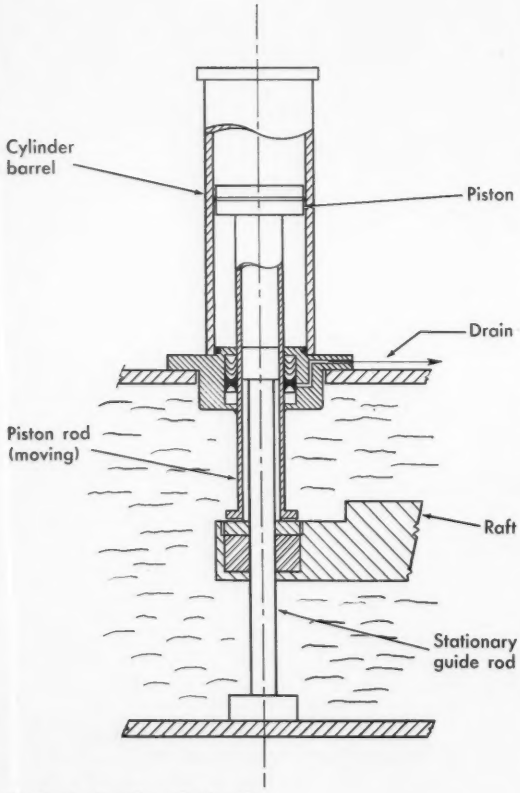
The only reasonable proposal seemed to be either a two ram system or a four ram system. Each of these systems appeared to be impractical, since the raft, which weighed several tons, must be kept level during raising and lowering to prevent jamming. However, a novel mechanical servo feed-back hydraulic system was proposed to maintain the raft in a level position. The four ram system was favored since it would provide stability in both the lateral and longitudinal directions, although it seemed to be more complicated. Stability and freedom from jamming were considered to be most important, and the four ram system was accepted.

One of the problems encountered in design was that no one was exactly sure of what forces would be encountered in service. It was expected that the ship might roll as much as 50 degrees from the vertical

Working on a development project under the sponsorship of the Royal Canadian Navy, engineers of Vickers-Sperry of Canada Limited have redesigned the leveling mechanism for the sonar gear on some vessels. The new design, which converts the system from mechanical to hydraulic, will eliminate a fouling problem that was causing operational failures. Here's the story of how the project was successfully completed . . . with prospects for universal adoption of the new techniques developed.



When both cylinder systems are not rotating at the same speeds the servo valve bleeds oil from the faster system to slow it down.



In the hydraulic cylinder the stationary guide rod is maintained laterally while a tube, attached to the piston, slides down around it.

and also that the sonar gear might come entirely above the surface of the water at times, in a heavy sea. This would mean that the full weight of the ship would act to drive the sonar gear down into the water.

Under these conditions, it would be extremely difficult to calculate the forces which might be encountered. It did not appear to be practical to measure these forces in actual service, and some assumptions had to be made. It was expected that the rolling of the ship would create lateral forces which would tend to cause the two cylinders on one side to lift, and that the forward motion of the ship would cause the two aft cylinders also to lift. Further, these forces could occur when the handling gear was in motion or in the locked position. To prove out the system after it was built, a complete handling gear was set up and loads were applied with other hydraulic cylinders to simulate the wave action and motion of the ship. These loads were applied suddenly and in all directions to simulate the extreme conditions.

The servo system used is illustrated at the left. There are four of these systems, one between each adjacent pair of cylinders. This is a purely mechanical system which involves no electrical components, other than limit switches which signal the extreme limit of the travel. A mechanical system was preferred due to the possibility of power supply failure on board ship, and the necessity of being able to operate the system by hand using a hand pump if required.

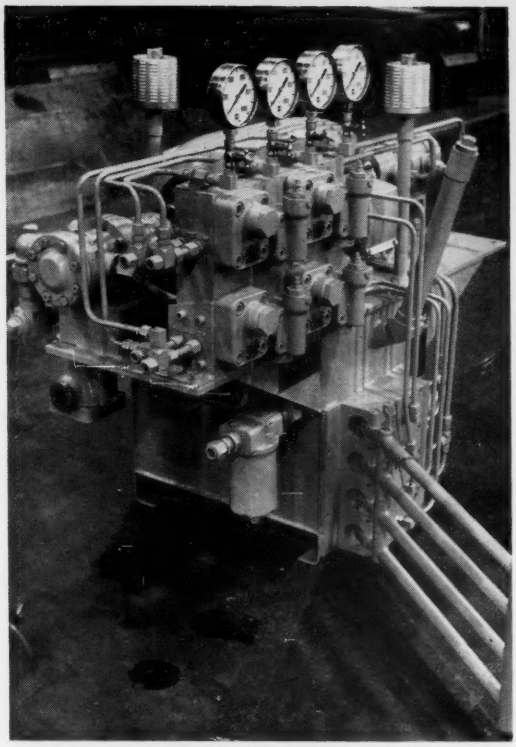
A simplified hydraulic circuit for one cylinder is shown on page 55. There are four identical systems which are built into one complete power unit package. All valving was mounted on a steel manifold which had drilled passages to carry the flow of oil. This type of construction reduced the possibility of leakages and provided a unit which is highly resistant to shock and vibration.

Material selection was important

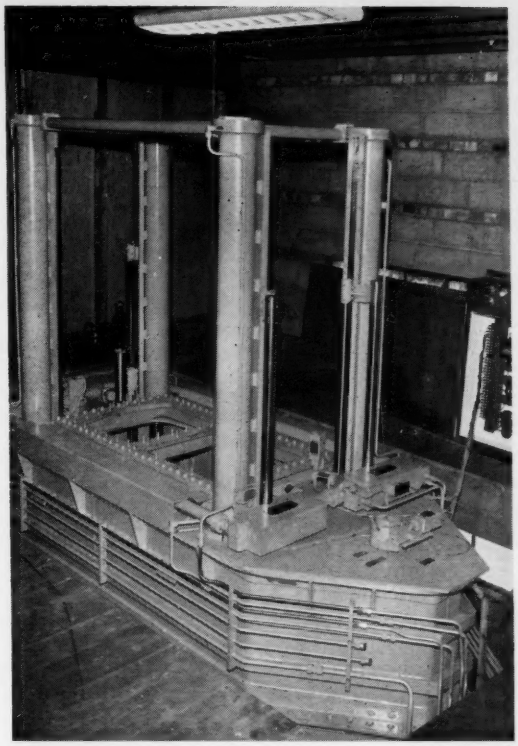
Particular attention was paid to the selection of materials to reduce the possibility of corrosion. The piston rod tube was made of Monel and chrome plated, while the stationary guide rod was made of stainless steel. These are both in the flooded area and will be subject to the same calcareous deposits and abrasion which so seriously affected the screw and phenolic nut arrangement of the previous handling gear. Since the piston rod is smooth and chrome plated, it is expected to be more resistant to this deposit and to abrasion. Also, a wiper ring on the bottom end of the cylinder gland will assist in cleaning off the tube as it is drawn back up into the cylinder on each stroke. The effect of galvanic corrosion due to interreaction of dissimilar metals was given considerable thought, and selection of materials was guided by this factor.

The seals on the hydraulic cylinder were designed specifically for this job and have two sets of chevron packings. One set faces out to keep the water out of the cylinder, while the other set faces in to keep the oil in under pressure in the hydraulic cylinder. A space is provided between these two seals which is drained to the inside of the ship. This drain chamber can be checked periodically to determine the state of the seals.

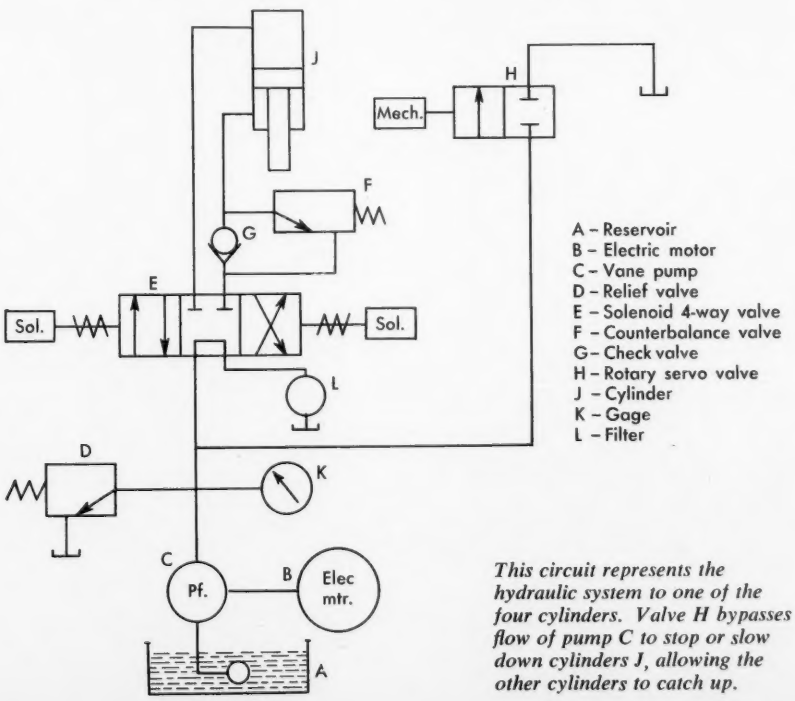
When the unit was finally assembled and tested, the raft could be maintained in a position parallel to the top of the sea chest within .020" under all conditions of simulated load. Even when a wooden block was used to jam the raft at one corner, the raft maintained its position. ★



The hydraulic power unit is completely sealed, except for air breathers, to prevent oil loss when the ship is rolling. Emergency hand pump is in right foreground.



Modified system for extending and retracting the sonar gear through the bottom of the ship. Only the stationary part is visible.



A – Reservoir
B – Electric motor
C – Vane pump
D – Relief valve
E – Solenoid 4-way valve
F – Counterbalance valve
G – Check valve
H – Rotary servo valve
J – Cylinder
K – Gage
L – Filter

This circuit represents the hydraulic system to one of the four cylinders. Valve H bypasses flow of pump C to stop or slow down cylinders J, allowing the other cylinders to catch up.

FPS: doing a big job for fluid power

The organization and plans of the Fluid Power Society are outlined by its executive vice-president, Barrett Rogers

The term fluid power in its present concept is becoming used more universally to cover power transmission by hydraulics and/or pneumatics. Although the art is old, it is only during the last two decades that it has come into prominence and its widespread field of application recognized. The Fluid Power Society has been formed to bring together all persons engaged or interested in any activity which may further the development and use of fluid power and the dissemination of knowledge pertaining to it or related subjects.

Prior to 1953 in Canada or the United States there was no technical society or association devoted solely to the interest of those engaged in the fluid power field. It is true that one of the older engineering societies operating in these countries had a hydraulics section in its organizational structure, but this was interested primarily in the hydraulics related to power generation, not power transmission as we view it. For example, the interest was in such things as the design of penstocks and the cavitation of turbine impeller blades. The term hydraulics was connected more with the field of civil engineering and the loss of pressure in water distribution systems, drainage and the measurement of flow in pipes and over weirs and dams. Engineering schools offered courses in hydraulics and fluid mechanics, but their content covered little of interest to fluid power technicians other than an understanding of some of the basic laws or theorems such as Pascal's and Bernoulli's.

There was, however, one group that specialized in hydraulics as we like to think of the term, and that was the National Conference on Industrial Hydraulics, organized in the post World War II era. They hold a two-day meeting annually in Chicago under the sponsorship of industry and the Illinois Institute of Technology. Of latter years it has included pneumatics in its program.

Automotive industry needed standards

In the automotive manufacturing industry there was a feeling some years ago that steps should be taken to establish certain standards, principally in performance for use in their production processes. The result was the Joint Industry Conferences in which hydraulics and pneumatics were recognized as important factors in production techniques. These Conferences, called about every five years, served good purposes; but they were limited in their coverage and effectiveness due in part to a lack of formal organization in which suppliers had inadequate representation and fore-knowledge of conference agenda.

It was not until 1953 that the first formal organization with continuity in the fluid power industry came into being in the United States . . . the National Fluid Power Association composed of manufacturers of fluid power components. It was the author's privilege (with some past experience in the fluid power field) to help organize this group and to serve since then as its Executive Vice-President and Secretary.

Although primarily a trade association interested in developing markets for the sale of its members' products, there were two more important reasons for its organization. One of these recognized the trend toward the limited standardization of performance and products as evidenced by the Joint Industry Conferences, and with the lack of satisfactory forum in which suppliers could discuss these and other problems of mutual interest affecting their welfare. The other reason, and probably more prominent, recognized the lack of adequate educational facilities and the need to improve the dissemination of knowledge of fluid power at all levels from research and development to operation and maintenance. Therefore, it was only natural that in its organization and during its operation for eight years, its Technical Board and its Education Committee have received major attention.

One of the problems faced at the time of the NFPA organization was whether membership should be limited to companies or be open to both companies and individuals. It was recognized that there were many persons, such as employees of users of fluid power, educators, consulting engineers, and distributors, who were greatly interested in the subject. The decision was made to pursue the former course; but it was thought it would be better to build a strong organization of this type before undertaking a more extensive program.

Each year thereafter, the National Fluid Power Association's Board of Directors re-examined and reappraised the situation, and finally in 1956 authorized a study of the feasibility of an organization based upon individual membership. Ultimately it was decided to take steps to organize such a technical society under NFPA sponsorship. It was decided to pattern the new organization after the general structure of several successful technical societies — the Tool Engineers, Foundrymen's, the Society for Metals, Standards Engineers, and many more—and to operate through local chapters. Constitution and By-Laws were drawn up and all that was needed was an initial group.

Need continued to grow

The need for such an organization became more apparent as the use of fluid power was increasing at a more than average rate . . . probably topped only by electronics. It reached into many fields of utilization —industrial, aerospace, marine, mobile, materials han-

dling and farm implements. There was an increasing shortage of well-informed personnel in research, development, design, application, operation, maintenance and education.

Education in the technique was not keeping up with the demand for applications. Problems were confronting the equipment manufacturers due to lack of knowledge of proper care and operation by the users. Some of the engineering societies which had shown a limited interest in fluid power, usually at a highly technical level, had membership requirements such that the man without an engineering degree or extensive experience was ineligible or was lost in the environment. It was recognized that education was vital for the continued growth of the industry. As stated earlier, there are very few courses available in engineering colleges and technical institutes relating in whole or in part to fluid power. The best instruction was being offered within industry by component manufacturers to their own personnel and a few fortunate customers.

Recognizing this, a group of instructors in hydraulics in the Detroit area, who had attended a special course offered by Vickers, Inc. during the winter of 1956-57, decided that it would be a good idea to continue to get together and exchange training experiences. Thus the Industrial Hydraulics Training Association of Detroit came into existence in the Fall of 1957.

The new Society is born

Sensing in this organization an ideal nucleus for its technical society, the NFPA entered into discussions with the Industrial Hydraulics Training Association and ultimately offered this group the opportunity to become Chapter 1 of the Fluid Power Society. This offer was accepted. That was in the Spring of 1960. Since then the growth of the Society has been phenomenal. In less than one year over 1,000 persons have joined the organization. The majority of these are located in the United States and Canada, with others in Europe, Asia and Australia.

The success of the organization can be attributed primarily to the fact that there was a great need for a technical society in its field; and the corollary is true — the success is also due to the contribution of the time that has been given by the organizers of the Society as a whole, and of the Chapters.

The Fluid Power Society is primarily an educational institution like many of the other technical societies; but unlike many of the older engineering societies, membership is unrestricted by requirements of academic degrees or professional status based upon experience in its field. **Anyone interested in fluid power may join, regardless of educational background or years of experience.** This is intentional in order to bring together all persons interested in fluid power whether they be researchers, graduate engineers, application specialists, operators, maintenance men, sales personnel, educators, students, manufacturers, or any of the many classifications which make up the industry as a whole. There is only one grade of membership.

It is hoped that as the organization grows we will see more and more members from the installation, operation and maintenance groups, for they are the persons we must look to and depend upon to prove to the world that fluid power is all we claim it to be . . . safe, reliable, flexible and economical.

Although membership is on an individual basis, the Society carries on its principal activities through local Chapters which meet at least once each quarter to discuss problems of interest to their own members.

Keep your eye on this button

It's the symbol of The Fluid Power Society . . . the new force for the advancement of fluid power knowledge and applications throughout the world. Already there are over 100 members of the Society in Canada. Make sure the next time someone discusses fluid power design or components with you that he wears the badge of his profession — a membership pin of The Fluid Power Society.

Much latitude is permitted Chapters in determining their local fields of interest. Some Chapters may contain several sections; in the larger industrial areas there may be more than one Chapter, each serving a different major field, such as aerospace or industrial. Ten FPS members may organize a local Chapter.

Expansion is world-wide

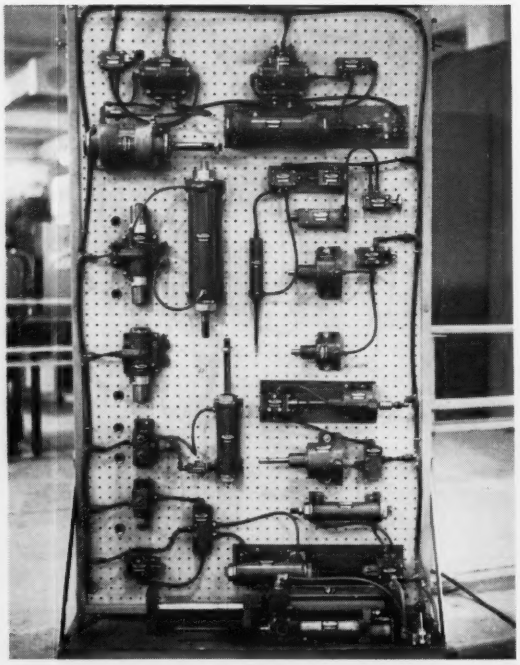
As this is written, sixteen Chapters have been established and many more are in process of organization. It is expected that in a very few years there will be local units in all of the principal cities of the United States and Canada and in other parts of the World. It was a signal occasion when the Society "went international" with the founding of the Toronto Chapter on January 25, the first Chapter of the Society outside of the United States. This was followed by the chartering of the Montreal Chapter on April 6. Both of these chapters were sponsored by the publishers of Design Engineering.

One of the principal objectives of the Society is to improve the educational setup in schools and companies with respect to instruction of fluid power and related subjects. Steps are being taken in conjunction with the National Fluid Power Association to establish an International Committee on Fluid Power Education. Some valuable work has been accomplished along this line, but there is still much to be done in the way of preparation of outlines for courses of study from elementary through advanced fluid power, text books, training aids, laboratory equipment availability, curricula guidance and research fellowships.

In the trends toward standardization of products and performance, there is much that the Society can do in co-operation with other groups in carefully analyzing and weighing the advantages and disadvantages of such moves, for it is generally acknowledged that there is such a thing as over-standardization and over-simplification.

The future of the Fluid Power Society is looked upon with much optimism as the use of fluid power will continue to expand in its present fields of application, in additional replacements of other means of power transmission and in uses where other means have failed. ★

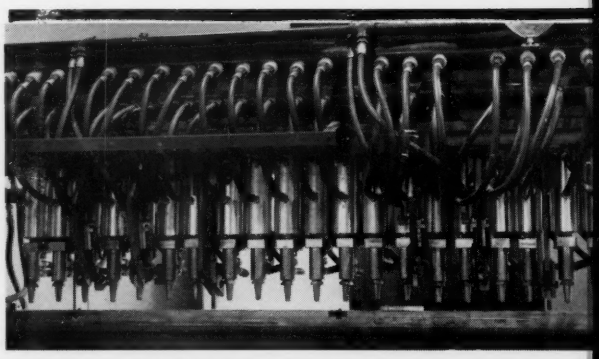
Use of air power for index tables with automatic drill feed was demonstrated by Bellows-Valvair, Limited.



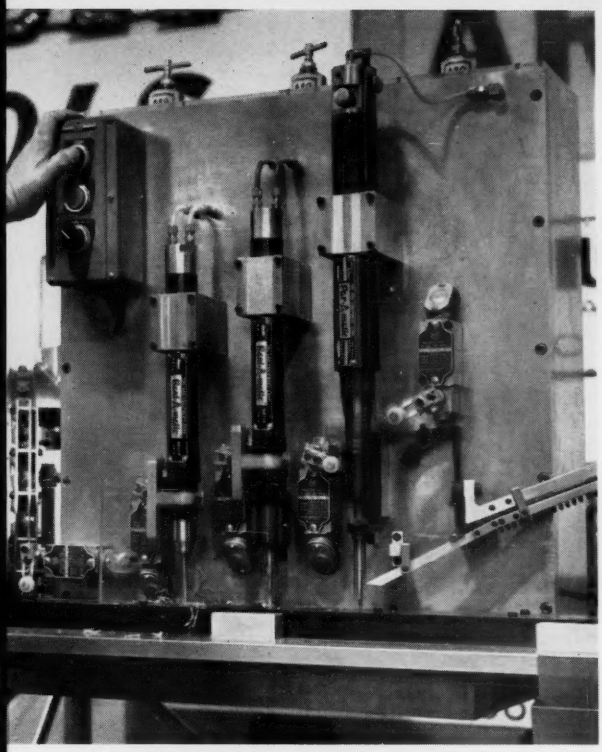
Westco Pump and Engineering, Ltd. showed a series of valves and cylinders operated by push-buttons.

Designews in pictures

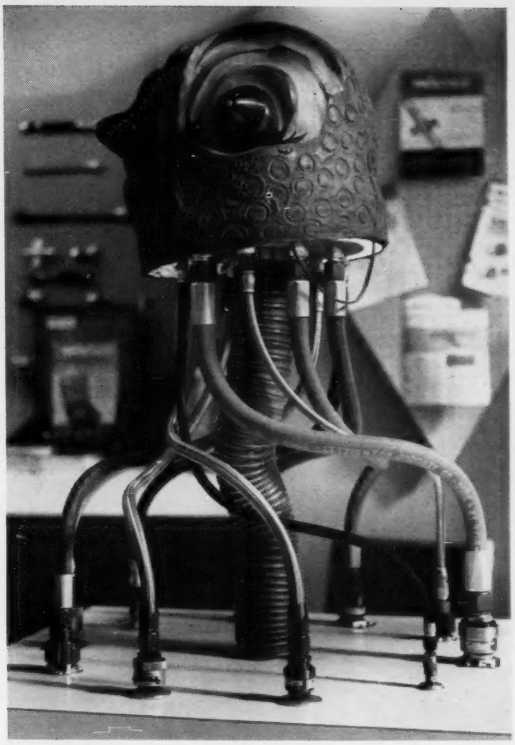
Fluid power was strongly represented at Toronto's National Industrial Production Show. Here are seven examples.



The business end of a pneumatic multi-spot welding machine designed and built by Progressive Welder (Canada) Ltd.



An air-tool that drills, taps and inserts screws automatically was featurea by Aro Equipment Corporation.



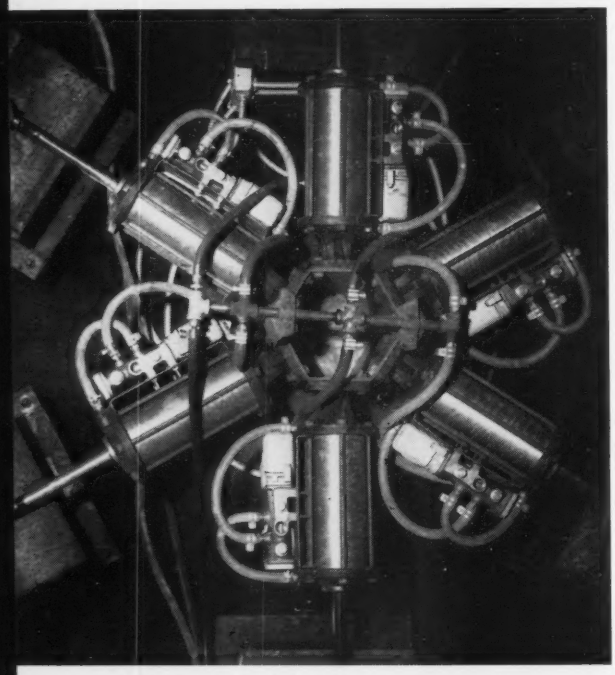
Aeroquip Corporation's demonstrator writhed up and down incessantly to show the flexibility of air hoses.

International Machinery Co. Ltd. exhibited a bending brake which uses Vickers hydraulic components.

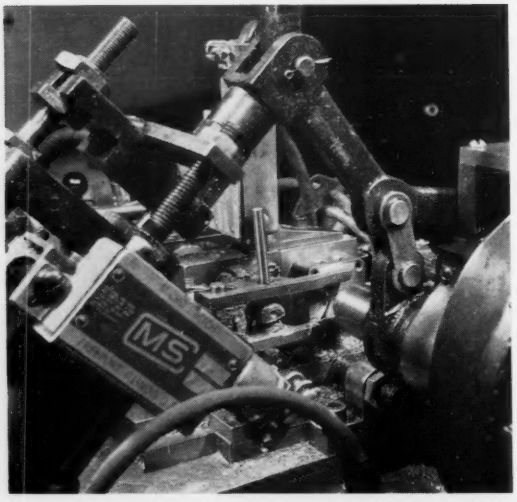
Versatility of stock parts is proved in this double spindle drill put together by Wainbee Tools Ltd.

Cylinders solve production headaches

Don Guy of Bellows-Valvair Ltd. suggests ways of applying the air cylinder to production machinery. As told to DE's editor Doug Kaill.



Pivot-mounted cylinders (as on front cover) in an automatic mold box in a foundry operation.



Formerly hand-operated, semi-automatic mechanism for closing a collett is automated with the use of air cylinders.

Suppose you were faced with the problem of rotating a work table weighing half a ton 15 degrees every seven seconds . . . advancing a production-line conveyor from work station to work station by the push of a single control button or switch . . . or raising and lowering a multiple drill-head at irregular intervals . . . how would YOU do it?

There is no greater challenge to the ingenuity and talent of the mechanical engineer in this age of automation than the design and manufacture of machine tools for production. And the problem is even greater when the complication of short runs is added. The answers to the simple questions we have posed above are not always as easy as they appear at first glance, and many a potentially profitable manufacturing operation has been abandoned because the right answers were not found.

The use of the proper tools is probably the one big reason why productivity in Canada and the United States is ahead of that in all the other nations in the entire world. But some of these other nations are fast catching up, and unless every effort is made to find the best solution in every manufacturing facility design assignment, there is some danger that we in America may be out-produced.

Almost anything is possible

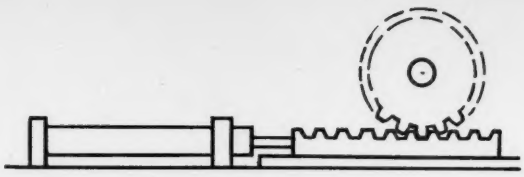
Today it is possible to design and manufacture machinery to perform practically any series of operations, no matter how numerous or complicated the sequences of operations may be. The only limitation placed upon the size and scope of these industrial monsters would appear to be that related to cost. And the operation of these complex machines of modern shops and factories is enough to strike fear in the heart of the tenderfoot engineer.

But these machines are really not as complex as first appearances would indicate. They are made up, in all cases, of very simple and straightforward components—each performing a simple and straightforward operation of its own. However, these components, while acting individually, are usually designed to impart a single, simple motion to some form of mechanism.

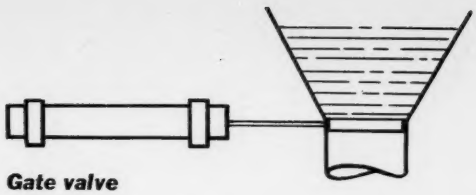
Take for instance, the basic component of most fluid power systems with which we are all very familiar—the cylinder. Most of us look upon a cylinder as a mechanical part capable of imparting motion in only one direction and in one plane. But when properly coupled with the right mechanical linkage the cylinder can be the answer to almost any motion mechanization problem with which we may be faced.

Let's discuss mechanisms

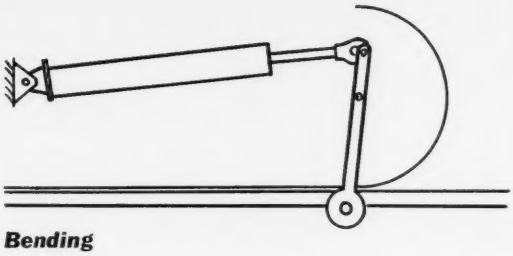
Mechanization of a motion is the resolution of the proper geometry of a connected system of rigid bodies



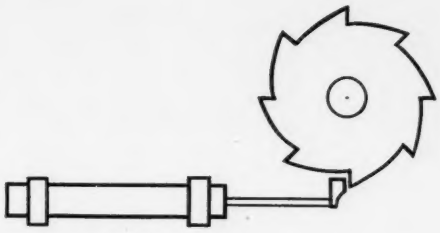
Rotation



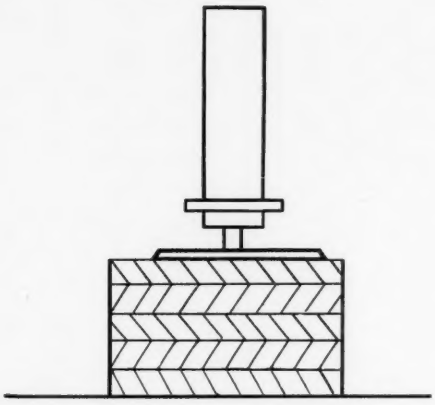
Gate valve



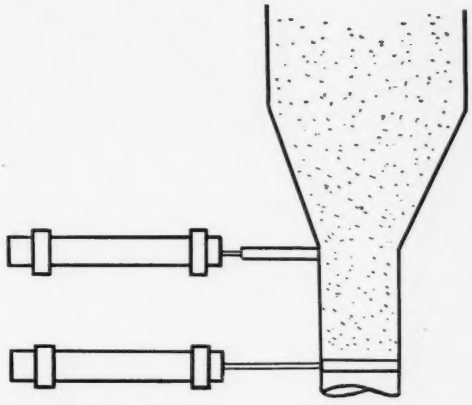
Bending



Rotary indexing



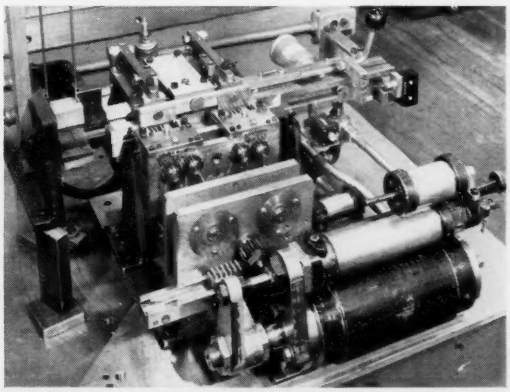
Clamping



Measuring

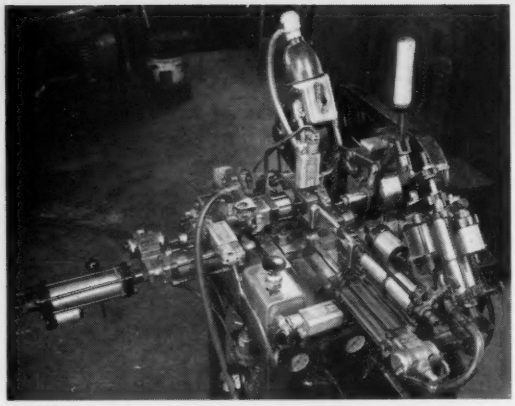
These simplified sketches show six typical applications of the cylinder for achieving mechanical motions.

Turntable used for locating parts for the assembly of hose clamps is indexed by a cylinder hidden underneath.

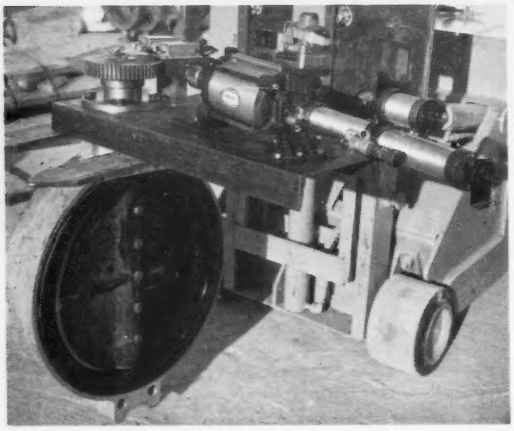


Cylinder push-pull motion combined with rack and pinion to locate material for assembly.

Continued ▶



Milling machine, originally manual, has been automated with cylinders for clamping, feeding and swinging a bell crank.



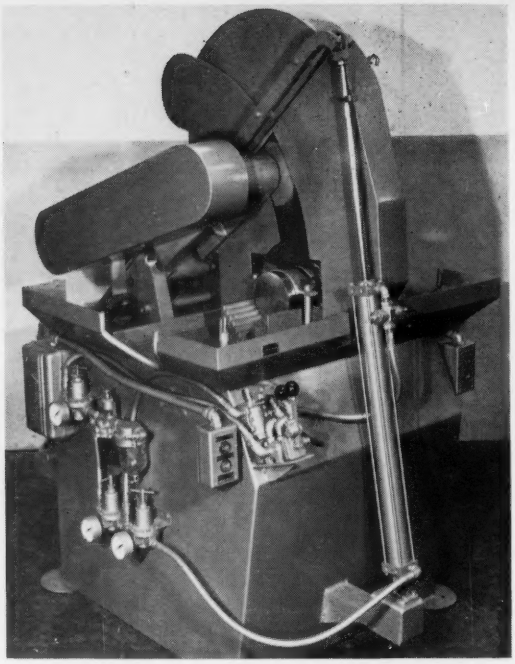
Butterfly valve is operated by a rack and pinion arrangement with an air cylinder.

so that the motion of each body in the system is constrained to follow a predetermined path relative to the others. Any movement of one member of the mechanical combination (say the cylinder) causes a controlled relative motion among the other members.

A mechanism is a motion converter. It converts a given input motion into the desired output motion. And for most of the mechanisms which are required in today's manufacturing machinery there is no better actuator, or input supplier, than the lowly fluid power cylinder.

But let's go back to our original problems. Rotating work tables of various sizes and weights is an operation used in many of our Canadian industries. Drilling, assembling, finishing . . . these are some of the related operations. Usually the table requires intermittent motion—very often the timing of the rotation must be coordinated with other associated operations; the latter may be either automatic or manual. A cylinder is possibly the first mechanism that should be tested for this type of operation. The controls can be either automatic or manual to suit the rest of the operation.

The real advantage here is the simplicity of the mechanical design. Any alternative system of drive



Cut-off saw blade is power fed by a long air cylinder. Note the hand controls.

would entail the use of complicated control systems, gears, clutches, or other expensive components. By contrast, a cylinder, pushing on dogs or other simple fixtures on the underside of the table, together with a simple valve to control the flow of air to the cylinder, is all that is required. This indexing arrangement may be combined into an automatic fluid power system by use of a series of valves and switches to provide any required cycle of operations.

Many other applications

Advancing a production-line conveyor is another assignment in the same category as rotating the table. It could be done with electro-mechanical drives incorporating clutches and the like, but the simplest method again is the pneumatic cylinder. Of course, we recognize that there is a limit to the length of motion that can be imparted with a cylinder.

Cylinders, quite obviously, can be made to perform much more complicated operations than the simple push-pull ones . . . but most engineers tend to forget this fact. Again the proper mechanical linkages must be incorporated to make up the full mechanism.

Rotating a body (could be a shaft during a grinding operation, or the diaphragm on a butterfly valve) is accomplished by a cylinder acting upon a rack and pinion. An oscillating motion is one that can be readily obtained from the same arrangement.

Punching, embossing, clamping and like motions are naturals for the pneumatic cylinder. Measuring a controlled volume can be handled by two cylinders. Hopper feeding, bending, sorting, forming, screw-machine feeding—all these and many more are yours with the least of equipment and the minimum of cost when you use the universal actuator, the fluid power cylinder, either pneumatic or hydraulic. ★

Design Show points up new trends

DE's assistant editor Tony Stevenson discusses the benefits Canadians can derive from the annual Design Engineering Show. He gives impressions of this year's show in Detroit.

Looking down one of the twelve aisles of exhibits at the show.

This year's Design Engineering Show proved significant in several ways. Not only did it reveal many new engineering ideas but it: established Detroit, once and for all, as an ideal exposition centre; demonstrated that trade shows can pull some weight even in poor economic times; and highlighted a new trend in marketing technical equipment and components.

For the four days of the show, more than $10 million worth of exhibits and products attracted 18,100 visitors to the show in Cobo Hall. Until the brand new exposition center was opened recently on Detroit's new-look waterfront, only three other cities had the facilities for a show of such size and scope. They were New York, Chicago and Philadelphia. But Cobo Hall proved itself to be perhaps the best facility on the continent and it could help Detroit, one day, to displace its mid-west neighbour Chicago, as the convention and exposition city of the United States.

The Design Show management made no official statements whether Cobo Hall would be used for future shows, but comments on the excellent facilities leave little doubt. The pleasant surroundings, the excellent lighting and the exhibitors' amenities make the Hall a boon to visitors and exhibitors alike. The only present draw-back is a threatening labor problem.

Braved the recession

The economic setback that North America has just weathered did not seem to have any ill effects on the show. If anything it heightened interest in new product development, often an aftermath of a recession.

To prove its success, the attendance was one of the best every chalked up. It was second only to New York attendances, which, after all, are expected to be the best since the location is at the heart of the nation's industry and commerce.

As in past years the show was an opportunity for the first public airing of many new products, including some developed for atomic and space age programs and just off the secret list. Under the one roof were 15,000 product ideas, all the result of research and development work in laboratories across the continent. An army of 4,000 technical experts was on hand to cater to the inquisitive, foot-weary visitors who had to comb seven acres if they wanted to see everything.

Resorting to gimmicks

If there is one general observation that could be made, it was the increased use of slick merchandising gimmicks. More than ever, exhibitors placed their reliance on sales aids, normally used in selling to the general consumer field, to attract interest in their new products. To bait the technical man on a plastic molding technique, literally thousands of plastic shovels were given away. One manufacturer even ran a dice game. Engineers and executives alike queued up to try to spell out the company's name with specially lettered dice. Each player registered his name and address for subsequent follow up by the exhibitor.

Some of these gimmicks attracted up to 10,000 enquiries. Since the total show attendance was 18,000 it meant a substantial majority of the visitors registered their names, or many came back for a second try or another sample. Exhibitors themselves admitted only a small fraction of one per cent of these would result in any definite interest. It's a high price to pay, but it points up a new direction in technical marketing.

Other gimmicks include pretty sales girls to answer technical enquiries, a magician and free ice cream and coffee. Some of the more successful were samples of nuts and bolts, lens cleaners for glasses and plastic stock parts. Visitors (including many company vice-presi-

dents) scraped through a heap of miniature reproduced tools like hammers, pliers and screwdrivers to complete a set. And to cater to those who just can't resist collecting, some exhibitors gave out paper carrying bags.

But if there was any exhibit that did not rely on gimmicks it was most certainly that organized by the Canadian Department of Trade and Commerce for the benefit of seventeen individual co-operating companies. While the tastefully designed booth attracted some attention from American show visitors, the individual exhibitors failed to shout loudly enough.

A spokesman for the Department of Defense Production, who closely watched the flow of enquiries said the relatively poor response to Canadian displays could be attributed to this failure to match the marketing methods employed in the U. S. booths. He said Canada undoubtedly had the goods and the technical capabilities, but it was not enough merely to build a better mouse-trap. The market had to be told about it.

Multimillion-dollar market

The departmental spokesman said there was a multi-million dollar market in the United States for military products and components, and it was the only such market in the world almost entirely free of tariff barriers. Thanks to the Department's Production Sharing program, most of the roadblocks of the "Buy American" legislation had been removed. He said Canadian companies trying to reach this market, as were the Design Show exhibitors, had to get out knocking on doors to show just what they were doing and what they could build.

Meanwhile DDP would follow-up any enquiries it had received at the show, and negotiate with Canadians capable of producing the goods in question. The spokesman reminded that DDP could help any Canadian firm that needed financial assistance for pre-production costs necessary in filling U. S. defense orders.

In spite of the slow response, most Canadian exhibitors felt the show was worthwhile. The Government provided them with the means of participating at a cost well below that paid by individual U. S. exhibitors in their own booths. The exhibit was distinctive, and only one exhibitor thought the name "Canada" was a burden to carry. His reason: the name conjures up, in American minds, false visions of an almost insurmountable trade barrier between the two countries. Next year he hopes to exhibit on his own since he feels the Design Show is all-important to Canadians wanting a fair share of the U. S. military market.

The tastefully designed Canadian booth was one of the biggest at the show.

Economics of engineering

There's been a lot of talk, in recent months, about such phrases as value analysis, cost analysis and quality control. Suddenly such problems have become the concern of the engineer and he has all but become an economist. At the Design Show, too, there was no conspicuous absence of this kind of thinking.

During the main conference luncheon, the immediate past president of the National Machine Tool Builders' Association, Alan Mattison had this to say: "Engineers must stop concentrating their efforts on mechanical improvements and start to concern themselves with economic significance of changes.

"Our world is fast changing," he said, "and it is the engineers' world. Competition is no longer restricted to business and markets. It has become a factor in national prestige and world politics. With greater understanding of economics by engineers, and greater appreciation of engineering by economists, there is a tremendous opportunity for growth."

At the opening session of the conference, held in conjunction with the show, the same theme was thrashed out by panelists, representing the four large automakers, who spoke on the theme: "Designing for Today's Competitive Markets."

One of the most obvious questions delegates threw at them was on the matter of planned obsolescence of modern cars. All defended their positions by trying to explain that today's auto designer was genuinely trying to give the customer the best for his money. No changes in models were made unless they were deemed economically advantageous or necessary to improve the safety of the car.

Another pertinent question was how far the new 12,000 mile warranty would be extended. The speakers answered by stressing the genuine attempt on the part of auto designers to make a car as reliable as possible. One said his company wanted to see a 100,000 miles warranty if possible.

Lessons to be learnt

There was much to be learnt at this year's show. And there were two main lessons for Canadian industry.

Firstly, Canada must teach her southern neighbour that she is a nation of no mean industrial importance. DE's staff was dismayed to hear the number of comments by United States engineers who failed to realize that Canada had such a demanding original equipment market. Others did not know that Canada produced components which were directly competitive (often with price advantages) with U. S. products.

Secondly Canadians must learn the worth of such an exposition and the important fund of new ideas that is available.

In the course of traveling to and from Detroit during the show, we were disappointed to see that very few of the passengers encountered in airline terminals were on their way to Cobo Hall. Even these few were going mainly to man a company's booth. United States firms recognize the significance of the Design Engineering Show and some sent teams of up to 20 engineers and executives. Canadians must come to realize they too can profit by it. ★

"Ingenious, Dez! You've redirected the stress, cut down the size, and almost eliminated machining! Who's supplying this terrific material?"

That's really great! DEZ EYNER!! Heh, heh, But you'd better put your real name on drawings from now on."

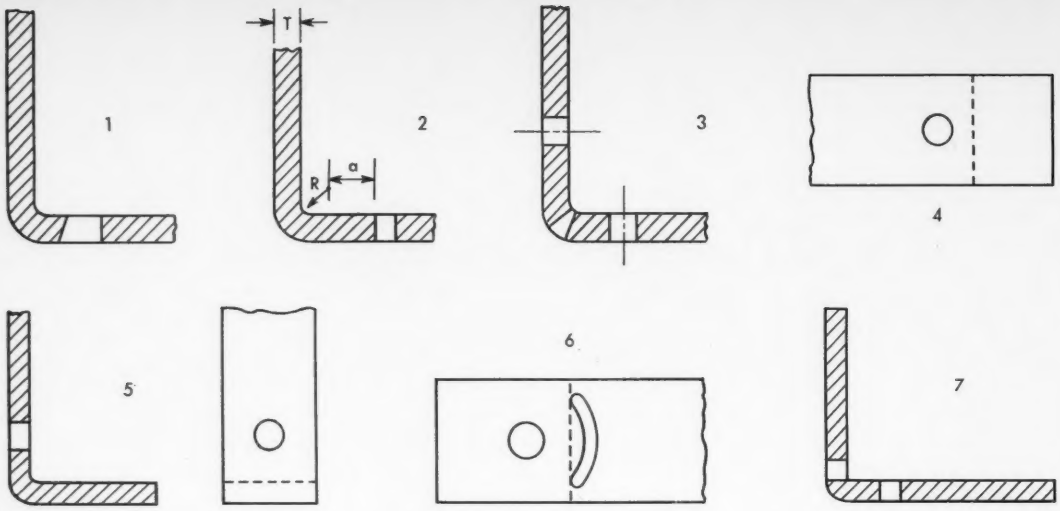
DEZ EYNER

"It works beautifully, Dez, but we generally approach consumer product designs on a different level from pure functionalism."

"I see they've got Dez redesigning miniature components again."

"So the boss is advertising for another designer. Where on earth's he going to put him?"

"I wonder who'll get tagged with 'Project Impossible' now that Jiggleby's been transferred?"



Hole punching requires proper design

Component designers can play a large part in cutting metal stamping costs

Cutting production costs is one easy way to increase profits. The component designer, for instance, can contribute in many ways to the reduction of production costs for sheet metal stampings. But this cannot be done haphazardly . . . it will only be accomplished if the many peculiarities of such components are given due consideration.

Take for instance, the simple matter of the correct location of holes in formed stampings. Obviously, the most inexpensive manufacturing process consists of punching the holes before the forming takes place. It can even be done at the same time as the blanks are cut. In fact, if the blanks are produced with a progressive die (or alternatively, a compound die, a cut-off die or shearing die), the opening of the holes costs nothing in labor. There may however be a slight additional tooling charge.

But the designer must bear in mind that the location of holes in bent or formed parts cannot be set arbitrarily. The one main fact to be remembered is that there is always some distortion in the bending zone whenever a piece of metal is formed or bent. The molecules on the inside of the bend are compressed while the molecules on the outside are stressed in tension. If a hole which has been punched previously in the flat blank happens to be too near to the bending line, it becomes distorted. Therefore it is always wise to locate any hole or slot in a formed part so that it is well away from the bending zone.

What are the safety factors?

The safe minimal distance of the hole edge from the centre of the inside radius is always open to argument. There does not seem to be a general standard. Recommendations vary rather widely. Some engineers recommend one and one-half times stock thickness; others use double thickness; over-cautious engineers are known who use three or more times the thickness.

The writer's experience has taught that the safe distance factor is not a fixed value, but it is variable. It depends chiefly on the stock gauge, the bending radius and the hole diameter; light stock, small bending radius and large holes require higher factors.

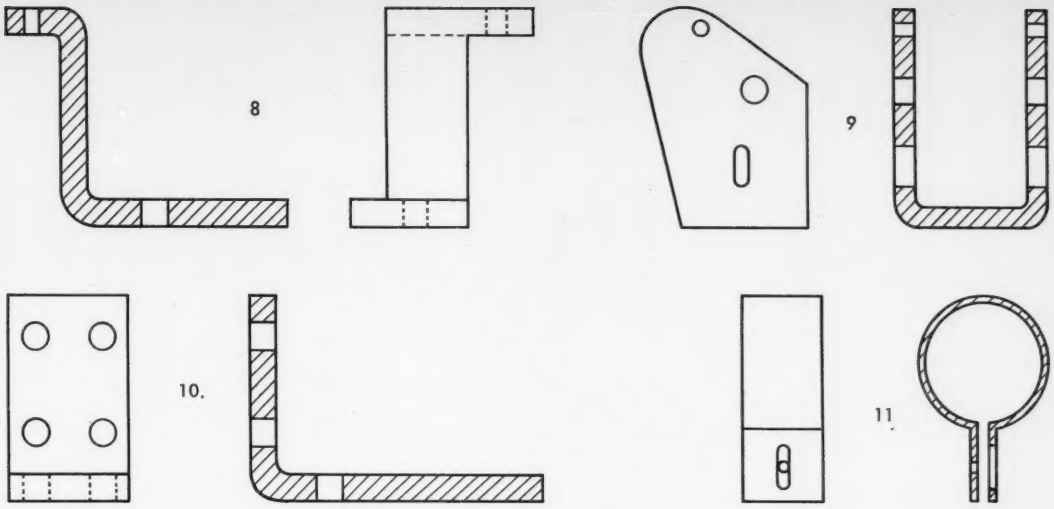
We recommend as safety factors the values given below:

	light stock		heavy stock	
	small R	large R	small R	large R
small holes	**2.25**	**2.0**	**1.5**	**1.25**
large holes	**2.5**	**2.25**	**2.0**	**1.5**

It should be noted that these factors apply only to round holes. In the case of rectangular holes or slots the safe distance must be increased because the stamping has less strength. It is recommended that the above factors be increased by 20%.

On the other hand there are exceptional cases where the kind of stock, its thickness, and the forming punch radius are especially favorable. Here the safety factor may be reduced, but the design must be examined closely. In the case of high precision jobs, no reduction is recommended.

When for some important functional reason the punched hole must be located nearer to the bending



to ensure increased profits

by Federico Strasser

zone than permitted by the above factors, the hole . . . if punched before bending . . . would most likely be distorted. The best remedy for avoiding this situation is to punch the holes after the bending is completed. In this way the holes may be kept perfectly round and their location maintained very accurately with respect to the blank contour.

This solution has one serious drawback . . . it is comparatively very expensive. As we have indicated previously, when the holes are punched with the blanking operation, they are obtained free; on the other hand, if they must be punched after bending, a second operation is required. To make matters worse, this second operation usually requires a lot of labor, and may cost as much as 10 or 15 times the cost of the first operation. Consequently tool engineers have devised a few tricks by means of which the holes may be punched before the bending operation, and yet be kept round after the forming.

Three major solutions

The chief solutions used are:

1. If there is enough space in the bending zone, then punch a small hole on the bending line itself. This hole will then be distorted during the bending operation, while the chief ones will remain practically unaltered, both in their shape and location.
2. Where there is not sufficient space in the bending zone for the punching of an auxiliary hole, make the chief holes slightly elongated. During the bending operation the hole will be distorted to an approximately round shape. Of course, the exact shape and size of the original hole cannot be calculated. These parameters must be determined by actual test.
3. Another solution consists of punching a regular round hole and then punching out a segment around it. In this way, the hole will remain intact and unaltered after the bending. However, the workpiece has its over-all strength reduced by this device.

All these solutions . . . and some others which may be used . . . eliminate the economic problem of increased labor and tooling costs. However, none of them is the perfect answer. In fact, both the shape and size of the hole cannot be held to close limits when these methods are used. Thus in the case of high precision jobs with close tolerances, it is necessary to do the punching after the bending, whenever the holes are located near to the bending zone.

And it is necessary to take this precaution not only when the holes are near the bending zone but also usually in the case of components with compound or multiple bends. Because of plastic flow and stretch, especially with thick stock and/or ductile material, the need to punch after bending is very common.

Sometimes, however, this trouble may be avoided, even in the case of stock with a comparatively high stretching index. For example, take the hose-clip shown in figure 11. Here a screw must pass through the two holes . . . the simplest solution is to elongate one of them. In this way the holes may be punched before forming, because slight inaccuracies due to the irregular behavior of the metal are compensated for.

Thus there are many different ways of getting around the problem of high costs due to multiple hole punching operations in formed parts. All that is required is a little ingenuity on the part of the designer. ★

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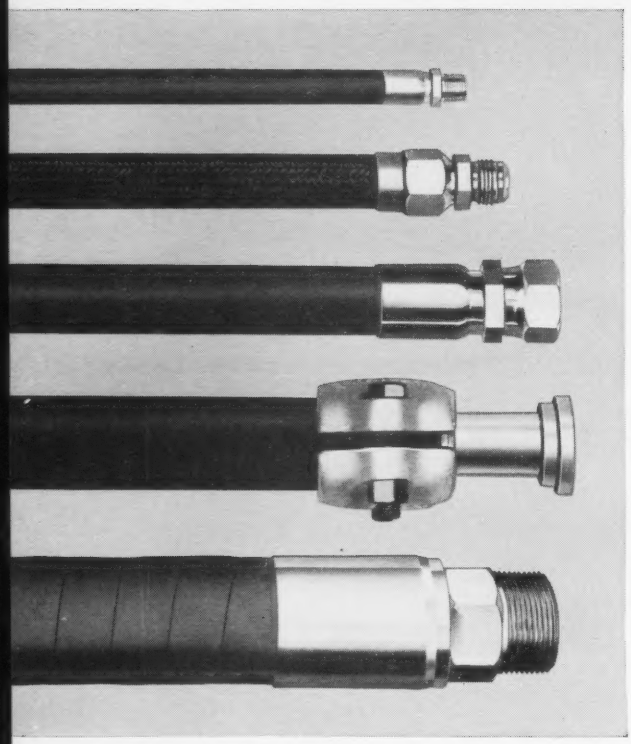

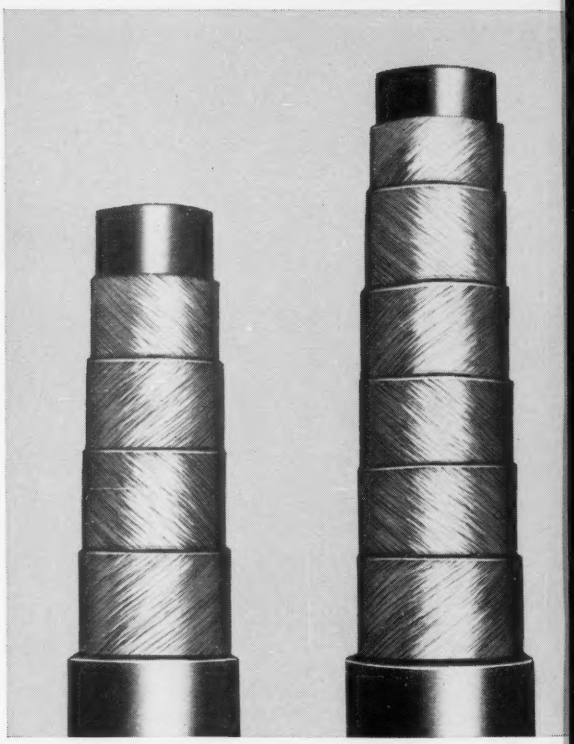

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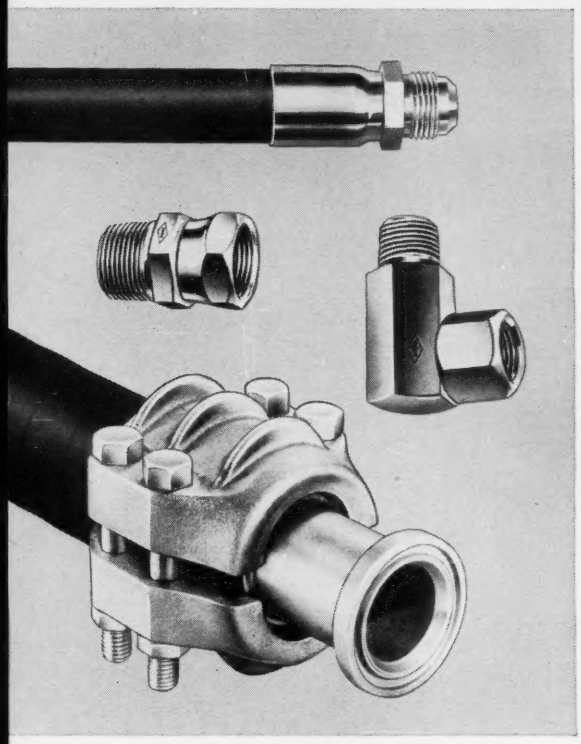

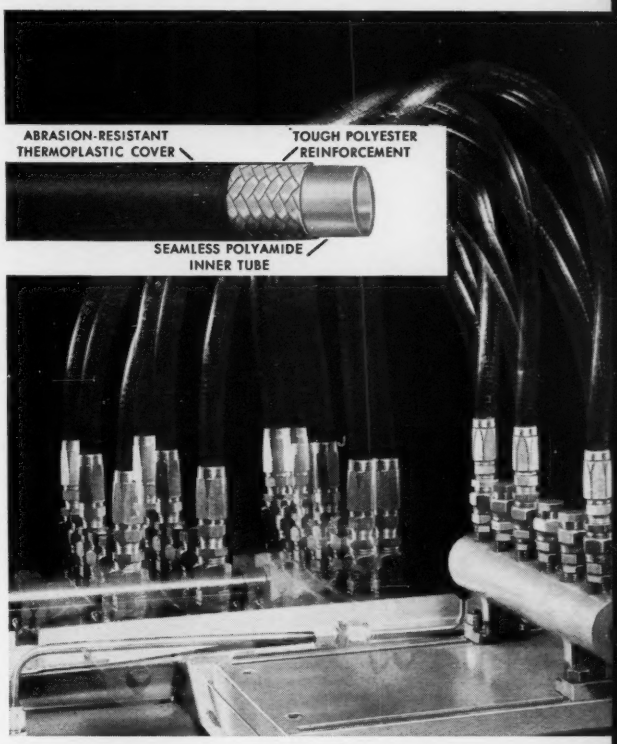

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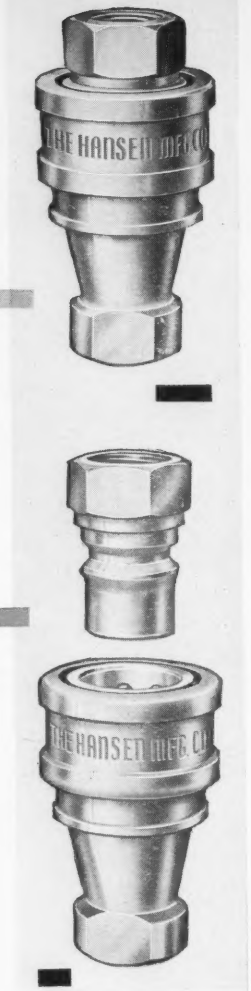
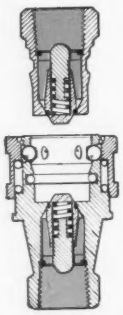


When Coupling is disconnected, identical valves in both the Socket and Plug provide instant shut-off of gas or liquid. To eliminate leakage or spillage during disconnection, the Coupling is so designed that shut-off takes place *before* the Plug separates from the Socket—and *before* the seal of the Socket itself, provided by the Socket "O" Ring, is broken.



In reverse, when Coupling is connected, the "O" Ring in the Socket completely seals Coupling *before* valves release flow of fluid from both sides of circuit—thus eliminaitng possibility of spurt of gas or liquid during instant of connection.

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Designers' book shelf

Engineered Castings, by Glenn J. Cook, Manager of Marketing, Foundry Department, General Electric Company. Publisher — McGraw-Hill, Toronto. 250 pages, Price, $4.75.

This book offers fundamental technical information in simple form. It is designed as an aid in getting the best industrial results in the design, application and purchase of engineered castings. The book covers practically all aspects of the field, including the various types of castings, how they are made, selection of metals, design factors, and how to sell castings. The author is a well-known leader in the castings field, having written many articles for magazines, and having given lectures at meetings of many foundry societies.

Circle 300 on Reader Service Card

The Design of Small Direct Current Motors, by A. F. Puchstein, Consulting Electrical and Mechanical Engineer, The Jeffrey Manufacturing Company. Publisher—John Wiley & Sons, New York. 400 pages. Price $12.

Perhaps the most interesting facts about this volume relate to its author. He writes from practical experience . . . and an unusual and remarkable educational background. His early training consisted of correspondence school courses supplemented by reading based on the books listed in the calendars of two universities. Without ever having attended university he was appointed instructor of electrical machine design at Ohio State University, and went on himself to receive his bachelor's and master's degrees.

This book is actually a compendium of methods for solving the problems involved in the design of direct-current machines. It may be used as a reference or a textbook. Problems calling attention to significant theoretical and practical points are included for the use of the general reader and the student.

Circle 301 on Reader Service Card

The following books have also been published recently:

Mechanical Engineer Practice (Fifth Edition), by C. F. Shoop and G. L. Tuve. Publisher — McGraw-Hill, Toronto. Price $8.

Circle 302 on Reader Service Card

The Consulting Engineer, by C. S. Maxwell. Publisher—John Wiley & Sons, New York. Price $5.95.

Circle 303 on Reader Service Card

Technical literature

Valves and Gauges—87 page catalogue of valves, cocks and liquid level gauges. Piston valves from ⅛ to 8 in., ball valves from 1 in. to 4 in., and sleeve packed cocks from 5/32nd in. to 1 in. made of various types of chemical resistant alloys. Joseph Robb & Co. Ltd.

Circle 304 on Reader Service Card

Air Cylinders—Revised bulletin on a line of air cylinders using U packers instead of O rings, on the pistons of the double acting types. John Spotton Co. Ltd.

Circle 305 on Reader Service Card

Connecting and Sealing—8 page booklet describing simplified methods for connecting and sealing with the V band couplings. Aeroquip (Canada) Ltd.

Circle 306 on Reader Service Card

Ontario's Development—The 1960 annual review of Ontario's industrial development. Department of Commerce & Development.

Circle 307 on Reader Service Card

Line Diverter—Specification sheet describing a new conveying line diverter for powdered and granular materials. Flotronics Inc.

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Cylinder Accessories—A new bulletin providing a method for quick identification of mounting accessories for square-type, industrial hydraulic and pneumatic power cylinders. Hannifin Co.

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Cushion Air Cylinders—Bulletin describing a new series of dimensionally interchangeable 250 psi cushion type air cylinders in bore sizes of 1⅛ to 14 in., with 20 standard mountings. The Sheffer Corporation.

Circle 310 on Reader Service Card

Flexible Couplings—Technical data on a large type of flexible couplings which is claimed to offer up to 3,640 hp. United Steel Corp. Ltd.

Circle 311 on Reader Service Card

Testing Relays—Technical paper entitled "The Co-Ordination and Testing of Protective Relays in Industrial Plants." W. S. Gerrie & Associates Ltd.

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Characteristics of Polypropylene — A materials bulletin describing properties and characteristics of polypropylene with

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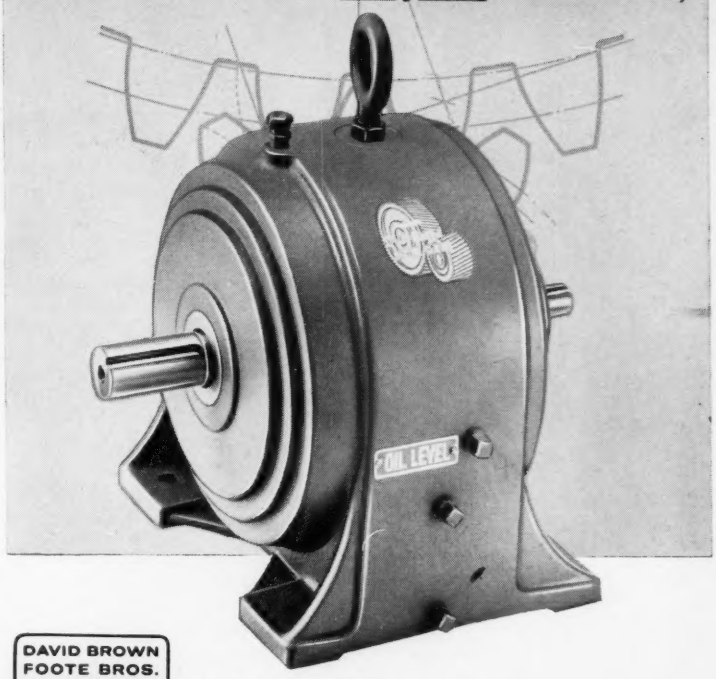

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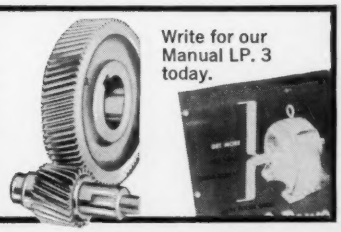

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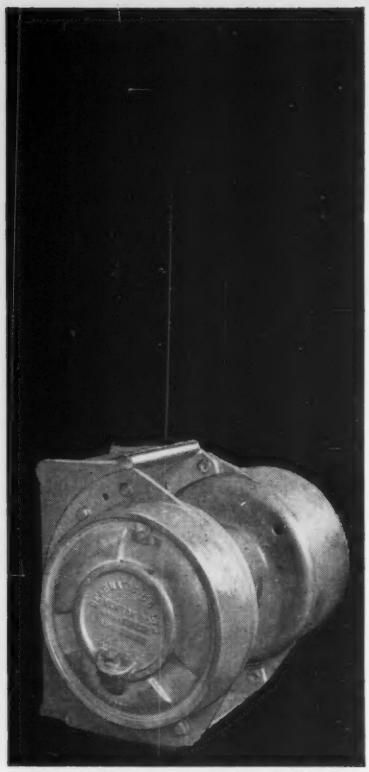

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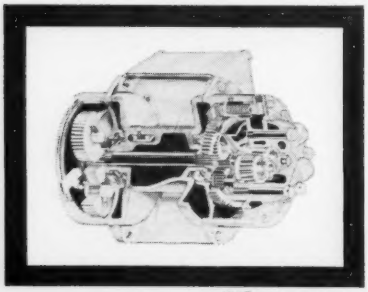

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Technical literature— *(Continued)*

tables on chemical resistance and suggested formulae for various processing methods. Eastman Chemical Products.

Circle 313 on Reader Service Card

Overhead cranes—a guide to the selection of electrical equipment for overhead cranes to ensure the maximum performances. Dominion Bridge Company Limited.

Circle 314 on Reader Service Card

Precision potentiometers—a short form catalogue detailing specifications on 1,544 standard subminiature precision potentiometers. Daystrom Limited.

Circle 315 on Reader Service Card

Phase shifters—Bulletin of a new line of precision phase shifters for applications requiring small size and accuracy. W. Hobson & Associates.

Circle 316 on Reader Service Card

Clutches and couplings—Brochure and catalogue describing a new line of clutches and couplings. Upton Bradeen & James Limited.

Circle 317 on Reader Service Card

Microwave tubes—16 page catalogue describing a complete line of microwave tubes, display devices and operational accessories. Also millimeter wave tubes and monitor Diodes. Litton Systems Canada Limited.

Circle 318 on Reader Service Card

Conveyor belt carriers—Bulletin featuring comprehensive data charts, drawings and lubrication details of complete line of conveyor belt carriers. Stephens-Adamson Mfg. Co.

Circle 319 on Reader Service Card

Magnetic recorder—Bulletin specifying an airborne magnetic recorder which records through 500 g. shock and survives 1500 g. impact without loss of data. Litton Systems Canada Limited.

Circle 320 on Reader Service Card

Sensitive pressure valves — A bulletin describing relief and back pressure valves designed for high sensitivity at low pressures. Canadian Meter Company Limited.

Circle 321 on Reader Service Card

Operation cryogenics—Booklet describing results from tests of 9% nickel steel vessels for applications down to minus 320 degrees F. The International Nickel Co. of Canada Ltd.

Circle 322 on Reader Service Card

Designing with lead—Publication illustrating the benefits and design factors favoring lead. Consolidated Mining & Smelting Company of Canada Ltd.

Circle 323 on Reader Service Card

Nickel alloys—Technical data sheet discussing corrosion resistance of nickel alloys. Wall-Colmonoy Canada Limited.

Circle 324 on Reader Service Card

Strip recorders—Bulletin describing strip recorders and round chart records for recording and indicating deviations from predetermined frequency. Canadian General Electric Co. Ltd.

Circle 325 on Reader Service Card

Slotted angle—Magazine, offered free, with news of slotted angle structures ranging from cable-reel stands to laboratory equipment. Dexion Canada Ltd.

Circle 326 on Reader Service Card

Bead chain timer—Bulletin discussing publication of a new bead chain timer in solving complex sequencing problems. Davis Automatic Controls.

Circle 327 on Reader Service Card

Gauges in valves—Two catalogues describing features, styling and size of liquid level gauge valves. Peacock Bros.

Circle 328 on Reader Service Card

Lead linings—Article describing five ways of lining a vessel with lead. The Consolidated Mining & Smelting Company Ltd.

Circle 329 on Reader Service Card

Electron probes—Engineering Report on beta-ray gauges and other electron probes working on the attenuation principle for measuring gas densities. Ontario Research Foundation.

Circle 330 on Reader Service Card

Digital controllers—Bulletin describing a new line of digital setpoint comptrollers. Davis Automatic Controls Ltd.

Circle 331 on Reader Service Card

Mercury lamps—28 page booklet with complete information about mercury lamps including construction, designation, performance, spectral characteristics and auxiliary equipment. Canadian Westinghouse.

Circle 332 on Reader Service Card

Tunnel diodes—96 page book on how to use tunnel diodes in electronic circuits. Canadian General Electric Company.

Circle 333 on Reader Service Card

Heating racks—Brochure on a line of electric heating racks containing charts and tables on installation and performance. Pioneer Electric Eastern Ltd.

Circle 334 on Reader Service Card

Manufacturers slow off the mark

Canada's manufacturers have been slower to take advantage of the new Loans to Small Businesses program than have retailers and firms in the service industries.

During the first three months of the scheme (January-March 1961) 300 enterprises took out government-guaranteed loans totaling $1,876,345.

Only 47 loans worth $378,877 were taken out by manufacturers. The service industries (restaurants, hotels, motels, bowling alleys, etc) took out 131 loans worth $913,299, while retailers were next with 105 loans totaling $516,771.

No coffee break

Office employees in more than a quarter of Canada's manufacturing industries work through the day without a single coffee break.

This was revealed in a recent research project by the federal Labour Department which gives a cross-sectional view of working conditions.

Main observation in the conditions of plant workers during the five years 1955-60 was the rise in the percentage of workers now on a 40 hour week or less. It jumped from 58% in 1955 to 70% in 1960. Percentage of those working 44 hours or more dropped from 33% to 20%.

Office employees also enjoyed a shortening of the working week. Percentage of those putting in less than 37½ hours rose from 22% to 27%.

More engineers' jobs

A considerable increase in the employment of engineers during the next year or two has been forecast by the federal Labor Department. It estimates an increase of 5.5% a year during the period 1960-62, compared with only 4.2% in 1959.

However it also estimates that fewer institutions employing engineers will encounter hiring difficulties in the next couple of years.

More foreign control

Foreign control and ownership of Canadian manufacturing increased by one per cent during 1958, the latest year reviewed by Dominion Bureau of Statistics.

Ownership rose from 50% to 51% while actual control rose from 56% to 57% of total capital investment.

In the petroleum and natural gas industry foreign control dropped from 76% to 75% and in the mining and smelting industry fell from 61% to 60%.

Foreign control was smallest in railways, at 2%, and utilities, 5%. Foreign ownership of capital was far higher amounting to 29% in railways and 14% in utilities.

Considering the whole of Canadian industry there was no over-all change in control or ownership. Capital investment stood at 34% while control stood at 32%.

Japan's trade quotas

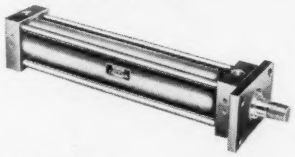
A sharply reduced rate for stainless steel flatware, a general hold-the-line policy on other items and more rigid controls on textiles sums up the 1961 quota levels for Japanese imports of sensitive items.

Agreement on the quotas was reached late in May after months of hard bargaining which began last December. It covers the largest number of items since Japan first imposed controls on competitive exports to Canada in 1956.

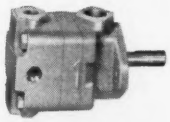
Japanese Ambassador Toru Hagiwara made it clear to Finance Minister Fleming that Japan would forego any major increases over 1960 quotas only because of generally poor economic conditions in Canada last year. ★

EVERYTHING HYDRAULIC
from components to complete systems

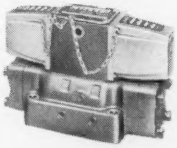
Whether your installation calls for a single pump and cylinder or a complete electro-hydraulic system, you enjoy convenience and technological benefits, too, when the choice is Vickers-Sperry. Fully qualified engineers are available to assist you in solving your problems from initial design to installation and start-up of the system in your plant. Here are highlights of the Vickers-Sperry line:



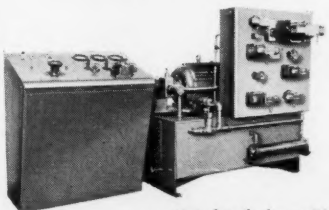
HYDRAULIC CYLINDERS—Standard bore sizes range from 1½" to 8", wide choice of mounting options available as well as special designs if needed.



PUMPS—Select from more than 500 standard models—vane or piston type, fixed or variable displacement—for oil or fire resistant fluids.



DIRECTIONAL VALVES—Solenoid operated, solenoid-controlled-pilot-operated and miniature valves cover entire application range. Models available for flows to 300 gpm, pressures to 3000 psi.



POWER PACKAGES—Both standard and custom engineered power packages are available from Vickers-Sperry. Standard components are selected from complete Vickers line to hold down costs. Rigid inspection and test before shipment minimizes start-up problems.

Get details by writing for Catalogue 5001C.

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Division of Vickers Incorporated
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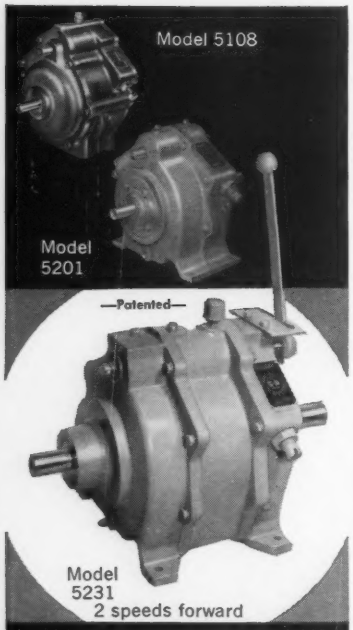
S-N REVERSING TRANSMISSIONS

5 models 8 and 28 h.p. with power packed versatility



S-N Reversing Transmissions are performance proven, space-saving single units which reverse under full load. Adaptable to the design or redesign of a wide variety of industrial equipment. For technical data write The Snow-Nabstedt Gear Corp., Hamden, Conn.

SPECIFICATIONS

Model No.		5231	5201	5108
Reduction Forward		1.97:1 3.34:1	3.16:1	3.75:1
Ratio Reverse		3.37:1	3.16:1	3.75:1
Power Up To		28 HP	28 HP	8 HP
Max. Input Torque in. lbs.		1000	1000	320
Max. Input Speed RPM		2400	2400	2400
Dimensions	Long	15 1/16"	11 1/2"	9 1/16"
	Wide	14"	13 1/2"	10"
	High	14 1/4"	14 1/4"	10 3/16"

SNOW-NABSTEDT
Industrial Division
Transmission Engineers
For Over Half a Century

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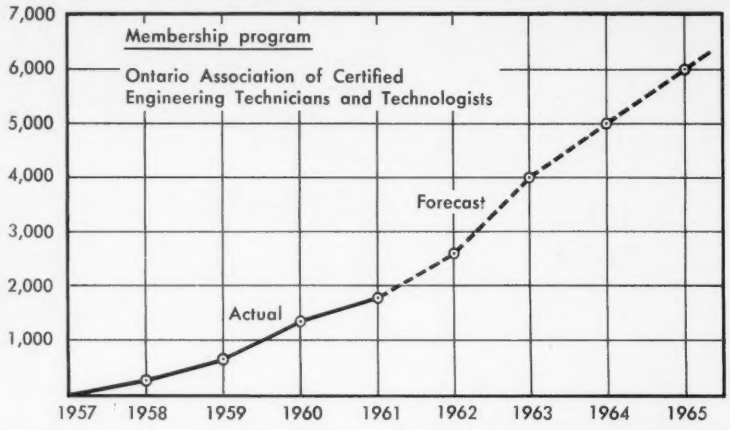
People . . . . . and events

Ontario technicians form an Association



Education was the one subject uppermost in the minds of those who took part in creation of the Ontario Association of Certified Engineering Technicians and Technologists at Toronto May 27, 1960. The day will go down as a milestone in the life of Canadian industry, since this was the first event of its kind in Canada and the United States, if not in the whole world.

Newly elected president of the 1,600-member association is F. A. Beeby of Belleville. First vice-president is H. P. Lansing of London, and 2nd vice-president E. W. Gordius of Toronto. Councillors are J. J. Kembley, Chatham; T. Smits, London; G. D. Coxon, Ottawa; A. M. Jacobs, Port Colborne; C. A. MacMillan, Sudbury and J. Reid, Scarboro.

Ontario is the only province with a certification program for engineering technicians and technologists (see DESIGN ENGINEERING, January 1961). It is reported that other provinces and certain U. S. states are considering implementing similar legislation.

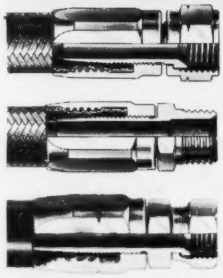
Most of the reports given during business sessions referred to activities in the educational field. Many of the local chapters are acting as co-ordinators in the organization of special evening classes for technicians. Mr. A. M. Moon, P.Eng., of the Ontario Department of Education reported on the recent Technical Training Conference in Ottawa.

Dr. George B. Langford of the University of Toronto was honored for his work in helping to develop Ontario's program for technicians with the presentation of a citation. Dr. Langford has served as chairman of the certification board for three years.

Hon. Robert H. Winters, P.Eng., in addressing the technicians, stressed the important future that they have in the growing economy of Canada. "Opportunities are limited only by the effort that the technicians are prepared to make" he said.

Specify LENZ INDUSTRIAL HOSE FITTINGS

RE-USABLE
INTERCHANGEABLE
COMPACT



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- CONNECTIONS
- 1 & 2 WIRE BRAID RUBBER HOSE
- RAYON HOSE
- ACCESSORIES

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People . . .
. . . and events
(Continued)

Telephone laboratory

Canada's first telephone research centre has opened near Ottawa.

Located in Northern Electric Company's research and development premises, it will double that company's present facilities and serve the parent company, The Bell Telephone Company of Canada. Prime function of the new centre will be to produce new ideas for improving Canada's communications.

Bell Telephone president, Thomas W. Eadie said the centre would share its findings with the rest of the world the same as the Bell Telephone Laboratories in the United States.

New Canadian 'plane

An advanced systems trainer version of the Canadair CL-41 is being developed for radar training of F-104G pilots in NATO air forces. Known as the CL-41R, the new aircraft has the same electronic equipment as the F-104G and uses the same characteristically long nose radome.

The Canadair CL-41 has been flying since January 1960 and is now ready for production as a primary and basic jet pilot trainer.

Shaw Process is here

A modern, economical process for the production of complete shapes weighing more than just a few pounds is now available in Canada.

It is the Shaw Process for precision casting which, until recently, was confined mainly to Europe and Asia. Now it is available in Canada through Deloro Stellite of Belleville, Ontario.

Developed by two British scientists, the new technique gives an accuracy and finish similar to the Lost Wax Process, but permits casting of articles up to 200 lb. In fact, one Japanese automaker successfully produced stamping and forging dies weighing as much as 3½ tons. One of its advantages to Canadian engineers was outlined in the June issue of DE, page 59.

Gray iron contest

DE's editor A. D. Kaill has appealed to Canadian designers to make a concerted effort to enter this year's Design Contest sponsored by the Gray Iron Founders' Society. Mr. Kaill, who is chairman of this year's judging committee, said winners would be announced in Toronto at

(Continued on page 76)

New OTC 10,000 p.s.i. Hydraulic Cylinders

- **PRECISION BUILT, POWERFUL, COMPACT, LIGHTWEIGHT**
- **THE FIRST ADVANCES FROM OTC'S NEWLY FORMED "PRECISION HYDRAULICS DIVISION"**

OTC 10,000 P.S.I. hydraulic cylinders open new possibilities in "hi-pressure" designing by meeting high force requirements with compact, lightweight components. Cylinders are precision built for dependable, continuous performance. Choice of stroke length and standard or tie-rod extension mountings for YD, YDS and YDT series cylinders. Requests for quotations invited.

New two-stage and single-stage 10,000 P.S.I. hydraulic pumps and power packages also available.

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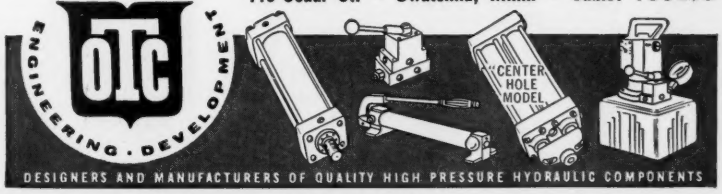

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For further information mark No. 157

People . . . . . and events *(Continued)*

the Society's annual meeting this fall.

Cash prizes totaling $850 will be awarded for the best gray or ductible iron casting designs. The contest closes July 15.

Previous Canadian designers who have submitted creditable entries are: John Romanczyk, Toronto; P. Powis, Arvida; W. H. Kinread, Welland; G. Robinson, Port Robinson; and D. J. Messenger, Orillia.

Appointments

C. T. Carson joined Smith, Hinchman and Grylls Associates (Canada) Ltd. as vice-president.

E. Wall appointed manager of planning and development for Aviation Electric Ltd.

Muir

Vidler

Carson

Wall

W. H. Schmalz appointed general manager, General Products division, Dominion Rubber Company Ltd.

A. F. Ryan appointed vice-president and production manager of W. B. McGuire Engineering Co. Ltd.

G. F. Howard joined Ex-Cell-O Corporation of Canada Ltd. as production manager.

M. B. Mairs promoted general manager of H. K. Porter Company (Canada) Ltd.

Elections

E. A. Ford, president of Canadian Institute of Steel Construction.

C. C. Muir, president Canadian Copper & Brass Development Association.

R. S. Eadie, president Canadian Standards Association.

W. E. Vidler, president Canadian Industrial Management Association.

W. C. Richards, president National Fluid Power Association.

C. L. Moon, chairman Hamilton-Toronto Section of the Standards Engineers Society.

$1,500 prize

First prize of $1,500 is being offered for the best entry in category 2 of the Stainless Steel design contest. It is open to architects, designers, artists and manufacturers for the design of components and accessories of a Branch Bank.

Other prizes of $500, $300 and $200 are being offered. Closing date is August 1, 1961.

A contest for category 1 (design concept of a bank) has already closed. First prize will be $3,000.

The contest is sponsored by the Stainless Steel Design Award Committee which includes representatives from Atlas Steels Ltd., The International Nickel Company of Canada Ltd., and Union Carbide Canada Ltd. ★

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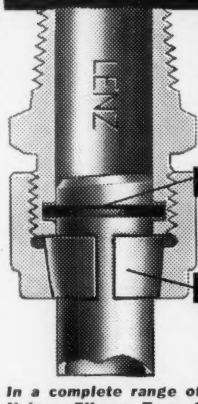

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The higher the pressure the tighter this O-Ring seals!

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The higher the pressure the stronger this split, tapered ring grips and locks!

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Dependable Fluid Power

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AIR — OIL — WATER SERVICE

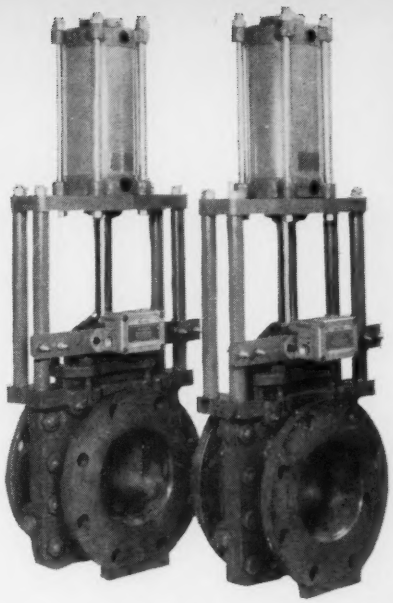
PRESS ROLL LOADING • VALVE OPERATORS
MACHINE CONTROLS • DOCTOR BLADES
REELERS • BARKERS • Etc.

Cowan Dynamics Cylinders are manufactured under the strictest quality controls and thoroughly tested before shipment for absolute compliance with our high standard of performance. Consequently, Cowan Dynamics Cylinders are extremely dependable and deliver superb performance year after year.

When you use Cowan Dynamics Cylinders you use the finest made.

That is why it pays to call Cowan Dynamics first.

Engineering Catalog No. 18-P on request.



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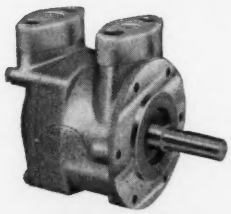
GRESEN HYDRAULIC PUMPS AND VALVES



VANE PUMP

MODEL TC

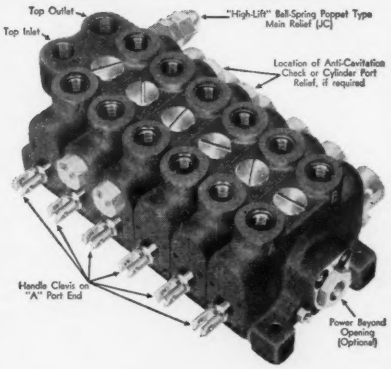
FEATURES: Balanced vane construction with dual vane feed, no-load starting (vanes retracted at slow speed), four-position inlet, clockwise or ccw rotation, ball type main bearing.

Max. Pressure: 1500 PSI

Max. Speed: 2000 RPM

Capacity: 3 to 24 GPM at 1200 RPM depending on model

GRESEN HYDRAULICS


Top Outlet
Top Inlet
"High-Lift" Ball-Spring Poppet Type Main Relief (JC)
Location of Anti-Cavitation Check or Cylinder Port Relief, if required
Handle Clevis on "A" Port End
Power Beyond Opening (Optional)

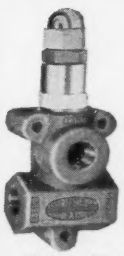
SECTIONAL CONTROL VALVES

MODELS 25P and 25PK

FEATURES: Available in assemblies of 2 to 8 spools; choice of 3-way, 4-way, free-flow, or 4-position float sections in any arrangement; handle at either end; load checks in all sections; anticavitation checks and either ball-spring or pilot-type cylinder port relief optional at one or both cylinder ports.

Max. Pressure: 2500 PSI

Capacity: 35 GPM



RELIEF VALVES

Model K
Ball-and-spring type

and

Model PK
Pilot operated type

FEATURES: Smooth quiet operation with minimum crack to full-flow pressure differential

Pressure Range: 400 to 2500 PSI for PK type, 400 to 2000 PSI for K type.

Capacities: Up to 40 GPM (PK type), 16-38 GPM (K type)

LINE FILTER

With filter condition indicator

FEATURES: Condition indicator tells when filter element must be cleaned or replaced, eliminates unnecessary service. Built-in by-pass. May be installed on suction line or return line. Choice of reusable 200 sq. in., 100-mesh wire cloth element or disposable 1400 sq. in., 10 or 33-micron, paper element. 1¼-in. NPTF ports.

Operating Pressure: 100 PSI
Operating Temperature: –65°F to 300°F

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Briefs

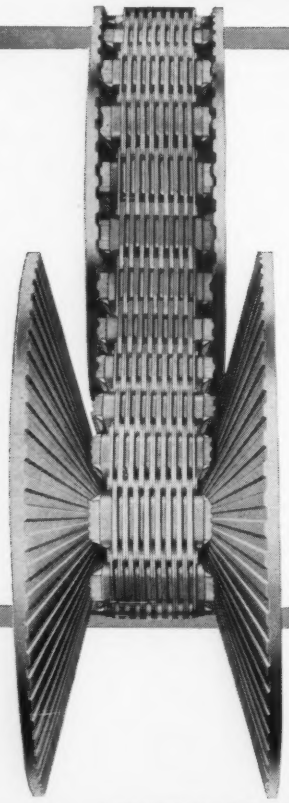
Fluid power: The mighty **Colorado River** has yet to completely adjust to the many changes in its regime, or condition of flow, that began in 1938 with the completion of Parker and Imperial Dams . . . two of the largest travelling **water screens** ever built have been supplied for Greater Vancouver's Seymour Dam by Jeffrey Manufacturing Company, Montreal . . . equipment for measuring water flow in **irrigation** channels is likely to become less expensive thanks to a new formula revealed by a professor from Israel now visiting Cornell University . . . the largest magnetic flowmeter ever made, a seven ton giant with a 78-inch diameter metering tube, has been delivered by Fischer & Porter for a Texas chemical plant . . .

Odds and ends: Even the Scots must think their **bagpipes** too noisy; eighty percent of the bagpipes they produce are exported — to Canada and the United States . . . the **cuppa tea** has assumed such an importance in the English office that Shell Oil has installed an automatic system in its new 44 storey building in London to send 30,000 steaming cups of tea to employees in about eight minutes . . . the word "deadline" originated in prison camps where it was the ultimate line over which a prisoner could pass before being shot; next time we set a deadline for an article from our contributors we'll mean business too . . .

UNIQUE IN ITS FIELD

THE P.I.V GEAR

POSITIVE INFINITELY VARIABLE



For a variable speed gear which is *positive* there is no alternative to the P.I.V. It is absolutely positive as the patent chain and wheel faces ensure "No Slip". An infinite variation of speeds up to a range of 6 to 1 can be obtained. The speed can be adjusted under load and will remain constant.

The high efficiency is maintained as the correct engagement of the chain with the discs is independent of stretch and other related factors. The gear has a very long life as no part is subject to wear except the chain; the life of which depends on the load, but can be reckoned in years.

FOR DETAILED INFORMATION WRITE FOR ILLUSTRATED CATALOGUE.

CANADIAN REPRESENTATIVES

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Material news: Aluminum and zinc are fighting it out with steel for a greater share of today's **automobiles;** forecasts say use of zinc should rise 17% this decade while aluminium could jump 350% . . . epoxy **bonding** materials are now available in pellets which eliminate skin irritation and difficulties in mixing and metering . . . Ontario Research Foundation believes concrete made entirely from basic **slags** from the blast furnace may be a commercial possibility . . . researchers have successfully joined the high heat resistant **columbium alloys** by both welding and brazing . . .

Airing the news: A jumbled mass of figures and letters is the modern way of describing an aircraft; **XKD2B-1/Z-12** is a new supersonic missile training target which simulates the speed, altitude and radar appearance of modern aircraft . . . another blow to **man's** pride is the fact that **women** have performed better as space-age pilots in test flights through millions of accurately simulated miles in outer space . . . a giant generator which once powered the Boston **subway** system has been pensioned off as the heat provider for testing materials for space flights . . .

Statistics: A recent survey to test the public's knowledge of great Twentieth century events showed that 71% did not remember World War I, 44% did not remember conditions before World War II, 57% could not recall a major depression, and 40% had forgotten Russia as an active ally during the war . . . profits on the sales dollar in Canada's manufacturing industry dropped to 4.4 cents in 1960, the lowest for 13 years . . . Japan's exports of steel products increased by 39% last year to hit an all-time high . . .

Talepiece: Digging wells is about the only business we know of where you don't have to begin at the bottom. ★

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RERATED FRACTIONAL H.P. MOTORS
1/20 THRU ¾ H.P.

R & M Frame 48 Motors are packed with competitive advantages for your product!

It's a dynamic motor — smaller, lighter, more versatile — engineered to give your product every competitive advantage when it comes to power. Designed for superior performance and long, trouble-free life under the most exacting conditions.

Lightness and compactness are due to selective use of light metals and more efficient ventilation.

Available up to ½ hp. 1725 rpm. single phase, and ¾ hp. 1725 rpm. polyphase. Protected or totally enclosed, rigid or resilient mount.

- **Easy access terminal box**
- **Dependable, silent centrifugal switch**
- **Precision machined rigid steel shelf**
- **Light weight die-cast aluminum end heads**
- **Precision die-cast aluminum rotor**
- **Choice of rigid or resilient mountings**

SPLIT PHASE | CAPACITOR START | POLYPHASE

Off-the-shelf availability gives you design versatility as well! You are offered a wide choice of mountings, bearings, mechanical and electrical characteristics.
R&M Frame 48 motors are manufactured under strict quality control to assure reliability. Custom engineered and designed motors are also available for any specific requirement.

For more detailed information, write today for Motor Bulletin 2005.

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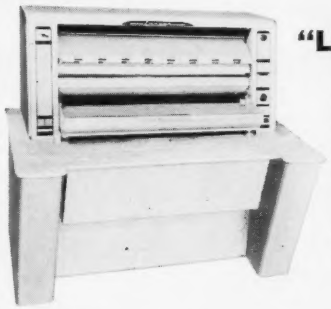

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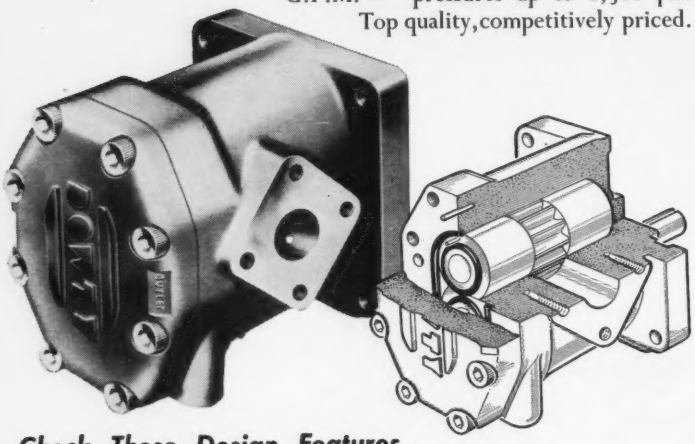
GEAR PUMP POWER
in the range you need

Dowty hydraulic gear pumps are available in four basic sizes . . . 14 models . . . one suitable for practically every application! Deliveries from ½ to 60 G.P.M. — pressures up to 2,500 psi. Top quality, competitively priced.



Check These Design Features

- ✓ Foot and flange mountings ensure maximum versatility.
- ✓ Cartridge construction for simplified servicing.
- ✓ Fully pressurized lubrication.
- ✓ Volumetric efficiencies over 90%
- ✓ Pressure balancing permits greater pressures without loss of efficiency.

Typical Applications

Earth moving equipment
Agricultural machinery
Construction machinery
Materials handling equipment
Drilling rigs
Marine machinery
General industrial equipment

Pumps	R.P.M.	Input H.P.	Delivery at Max. R.P.M. G.P.M.	Weight lb.
Size 1	500 to 2500	up to 6.7	5.5	4
Size 2	500 to 2500	up to 19.9	18.2	11
Size 3	500 to 2000	up to 38.0	42.8	29
Size 4	500 to 1500	up to 45.0	63.5	49.5

Performance Data

Also available . . . Gear Motors, Control Valves and Hand Pumps. Write direct or use the reader service card for data-packed leaflets on these products.

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BRITISH COLUMBIA: Tridel Equipment Limited, 1616 West 3rd Ave., Vancouver 9, B.C.

DOWTY *First in Hydraulics in Canada*

DOWTY EQUIPMENT OF CANADA LIMITED, AJAX, ONTARIO (Industrial Division)

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Letters to the Editor

Dear Sir,

I read with interest your remarks on Backlash page, of the April 1961 issue of DE referring to Canada's lack of translation facilities for Russian technical and scientific literature.

I can see the reasons for such a state of affairs. A technical translation worth that name requires adequate knowledge of the subject and a good command of both languages, including the scientific idioms. It also demands high integrity on the part of the translator, who, paid by the word translated, must not slide over more complicated passages without full investigation to achieve an exact expression of the author's thoughts.

Such work is usually undertaken part-time by a scientist or engineer. The amount of translation that can be coped with under these conditions does not warrant an advertising campaign in scientific journals. If there is a demand for translations in Canada, perhaps your organization could do the service of establishing a pool, through which both parties could make contact.

I am speaking from my own experience, being a professional engineer (M.Sc.Mech. Eng. Technical University of Lwow, Poland, 1937) with 25 years in plant and equipment design. For some considerable time I have been doing part-time free-lance scientific and technical translations from Russian, German, Polish and Czech into English. They have covered physics, chemistry and chemical, mechanical and electrical engineering (including electronics).

In this capacity I am offering my services to anybody who is in need of sound reliable translation of scientific and technical papers.

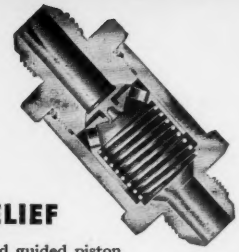
M.J. Kruzynski, P.Eng.
St. Hilaire Station, Que.

"Should I make the revisions on the old revisions, or revise the revisions on the new revisions?"

REPUBLIC VALVES

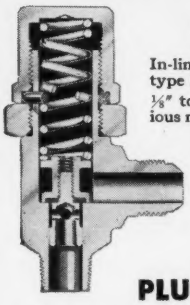
INDUSTRIAL • CHEMICAL • AIRCRAFT

CHECK



Quality Check Valves of several types—ball, poppet, Hy-pressure, Free-flow—all metals, various portings, and pressures up to 5000 psi. Pipe and tube sizes up to 2".

RELIEF



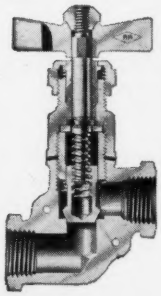
In-line and guided piston type Relief Valves. Metal or rubber seal. ⅛" to ¼" pipe or tube connections. Various metals. Many settings to 2750 psi.

Also Pilot-operated type, with quick unloading and silent operation, ¼" to 2" to 5000 psi. Remote control pilot available.

PLUG

Precision-made Plug Valves for wide general use in brass, aluminum alloy, or stainless steel, ⅛" to 1". +32° to 160°F. With Teflon plug, −65° to 250°F, without lubrication. Aluminum alloy or stainless steel.

GLOBE AND NEEDLE



Super duty shut-off valves, angle and offset, for up to 5000 psi service, ⅛" to 2", with mounting holes, and panel mounting brackets. Also high pressure Needle Valves for 10,000 psi. working pressure—proofed at 25,000 psi. One piece, stainless steel, ⅛" to ½".

LO-TORQ SELECTOR

Directional flow control for service up to 6000 psi. Balancing principle uses line pressure to make turning easy with short handle. 2, 3, 4-way, with various drillings. Side, bottom, and sub-plate porting. Panel mounting. ⅛" to 2".

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Distributors in principal cities coast to coast.

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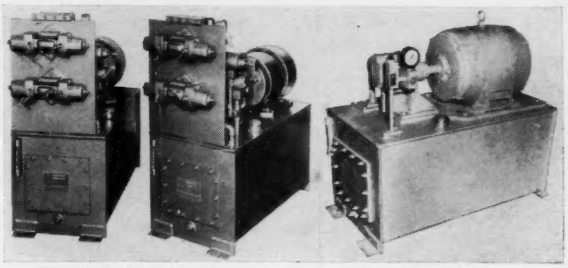
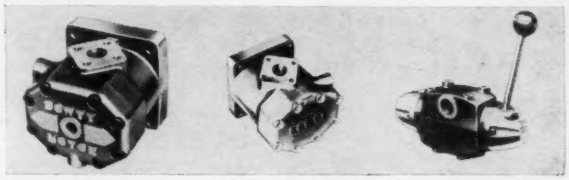


RHML Hydraulic Power Unit Model 10-30/2-65-1000 Made in Canada

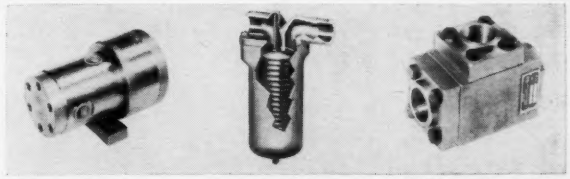
RHML Standard Power Unit 12 gpm 7½ hp 2000 psi max.



Dowty Hydraulic Motor to 30 hp

Dowty Hydraulic Pump 1 to 60 gpm Pressures to 2800 psi

Dowty Control Valves Capacity to 60 gpm both single and banked type parallel and series operation



RHML Hydraulic Lock Valves to 200 gpm capacity 3000 psi Made in Canada

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RHML Angle Check Valves 3000 psi sizes 1¼" to 3". Made in Canada

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Do you know your hydraulic fluids?

The first in a series by Harold Yarnell of Midland-Ross Corporation

The flammability of conventional petroleum hydraulic oils has always posed a safety problem for industry — one that has become more important with the increasing use of hydraulic power. Yet everyone in the field of fluid power regards petroleum oil as an old reliable friend, and finds it difficult to accept fire resistant hydraulic fluids as a replacement. Petroleum oils have been used successfully for years as the actuating agents in hydraulic equipment; but these petroleum base fluids are a serious fire hazard, particularly in those operations where the ignition of the fluid could result from a possible leakage or line rupture. On the other hand, a carefully installed petroleum oil system, with a reasonable amount of preventive maintenance care, is no more dangerous than the gases that are used in atmosphere type heat-treating furnaces, for example.

There are two general types of commercial fire resistant hydraulic fluids, known as water base and nonwater base fluids. These are sometimes called aqueous and nonaqueous base fluids. Each of these two general types may be divided into two so that four basic types of fluid are available.

PURE PHOSPHATE ESTER fluids do not have additives or thickeners to achieve their viscosities. Viscosity is maintained by constructing molecules of the same general classification, which exhibit varying physical properties. This type of fluid possesses good mechanical and chemical stability and is more resistant to oxidation than natural petroleum products.

PHOSPHATE ESTER BASE mixtures are, as the name implies, blends of phosphate esters and chlorinated hydrocarbons in a ratio designed to achieve the primary properties desired. This fluid, like the pure phosphate esters, also possesses good mechanical and chemical stability. It is also more resistant to oxidation than natural petroleum products.

WATER and GLYCOL mixtures are mixtures made from glycol blends and water. They are mixtures containing approximately 35% to 45% water with the balance being glycol blends. These fluids are compatible with seals and packings used with petroleum base oils but they do not have the lubricity of the phosphate esters or nonwater base fluids.

WATER in OIL emulsions consist of petroleum oils mixed with water and emulsifying agents. These fluids also contain 35% to 40% water and are compatible with seals and packings used with petroleum base oils. They do not have the lubricity of phosphate esters.

The term "FIRE RESISTANT" fluid includes water base and nonwater base types of fluid. Synthetic fluids are generally accepted as being of the nonwater, or phosphate ester type fluids. "HYDROLUBE" is a generic term, rather than a trade name, which was coined as descriptive of a fluid lubricant containing substantial quantities of water; hence "hydrolube" is considered to be fluid of the water and glycol type mixture.

Fire resistant does not mean the fluid will not burn, but rather, that it will not support combustion. Nonwater base fluids, or phosphate esters, are inherently fire resistant by their very chemical nature. While they can be made to ignite under certain severe conditions, they are self-extinguishing once the ignition source is removed.

The water base fluids are "snuffer" type fluids, whereby fire resistance results through the release of a protective steam blanket in the presence of high temperature. Thus a water base fluid depends on the water content for its fire resistance. When the water is allowed to boil away or evaporate, the residual fluid will burn, to a limited degree, when ignited, depending on water content. This residual fluid is also self-extinguishing once the ignition is removed.

Underwriters have rated the water and glycol mixtures as being the best, in terms of fire resistance, due to their water content; the phosphate esters are second due to their inherent chemical nature; water and oil emulsions rate just above petroleum oils depending on their water content; as the water is permitted to evaporate or boil away, their fire resistance lessens. In fourth place are the petroleum oils.

Probably the oldest, commercially available fluids were the phosphate ester base type. This product has been used for years as a fire resistant fluid in certain limited applications.

During the war the U. S. Navy through their Naval research laboratory searched for a less flammable aircraft hydraulic fluid, based on the well known inertness of water. In 1946, a laboratory program was initiated to adapt these fluids to the requirements of industry, hence the water and glycol mixtures. The youngest of the water base fluids is the water in oil emulsions.

Let's compare costs

Water base fluids are generally less expensive than the nonwater base fluids. Of the water base fluids, the water in oil emulsions are less expensive than the glycol mixtures. Water base fluids can use the same standard seals and packers that are used with petroleum oil products, while the nonwater base fluids (phosphate esters) will require a different type seal.

Water base fluids, having substantial quantities of water, do not have the lubricating qualities of the phosphate esters. Hence, service life of equipment cannot be expected to be as great as with nonwater base fluids.

Thus, water base fluids cost less initially and are easier to convert to; however, maintenance of equipment will be higher. Nonwater base fluids have a higher initial cost but save in downtime necessitated by equipment failure.

All fire resistant fluids have a higher specific gravity than a petroleum oil and will require larger mesh pump inlet strainers to compensate for the additional suction required.

Fire resistant fluids are wonderful solvents and reservoirs painted for use with a petroleum oil product must have the paint removed and replaced with a compatible paint or left bare. The water in oil emulsions require no change to paint. ★

To be continued next month

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Synthetic Resin Bonded

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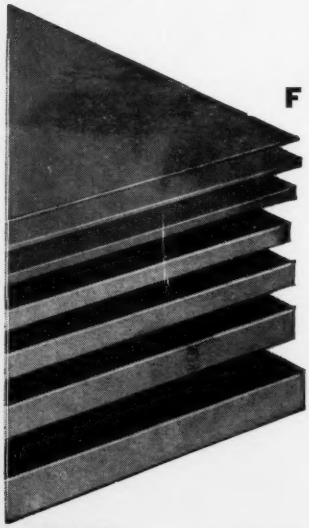
For silent gears and pinions (spark-proof too), bushes, washers, bearings and small mechanical parts . . . for jigs . . . for electrical control panels, terminal boards, etc. Formapex has special advantages — high strength/weight ratio, high dielectric strength, low co-efficient of friction, great resistance to heat, moisture, weak chemicals, etc.



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V.E.S.*

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* **Economy**

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* **Simplicity**

Available in kit form, ready-to-use, requires only basic hand tools for installation, absolutely positive acting closed circuit dual line system.

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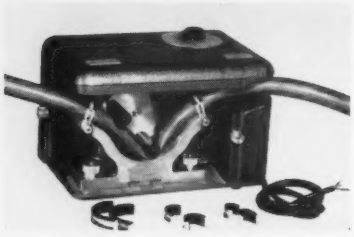
New products and materials

Pumps and motors

A new line of angle type piston pumps and motors rated for pressures up to 5,000 psi. A wide variety of controls, high pressure capability, instant response to controlling signal, and reversible flow make the units useable in applications such as cargo winches, planer drives, log carriages in those which include forming and extrusion presses. **Vickers-Sperry of Canada Limited.**

Circle 335 on Reader Service Card

Valveless pump



An entirely new type of British pump is now available in Canada. It operates on the principle of an elastic pipe fastened in a multi-curved track. A succession of meter driven rollers pass over the pipe flattening it against the track at the point of contact only. This "flat" accordingly moves around the curve of the track driving anything in the pipe before it. No valves are needed and the pump is instantly reversible. The flow rate is continuously adjustable from a few ounces per hour to 500 gallons per hour at pressures 790 psi or vacuums of .1 centimeters mercury. **Canadian Research Institute.**

Circle 336 on Reader Service Card

Expansion joint

A new rubber expansion joint that provides the same flexibility as standard joints but possesses 60 more capacity for withstanding high working pressures. It can handle corrosive materials and withstand a wide range of temperatures. A feature is its inner construction that enables the metal reinforcing rings to remain stable under pressure. **Dominion Rubber Company Limited.**

Circle 337 on Reader Service Card

New pumps

Two new lines of special application pumps with capacities up to 50 gpm. Certain models in the line will deliver discharge pressures up to 350 psig. The pumps feature a single moving element —the screw-like rotor stop turning within a fixed state, the rotor produces a sensation of traveling cavities which carry the liquid to the discharge end with uniform flow, low internal velocity, and positive displacement. Rotors are made of No. 416 stainless steel for corrosion resistance while the stators are of a synthetic rubber to fight abrasion. **The Robbins & Myers Co. of Canada Ltd.**

Circle 338 on Reader Service Card

Hydraulic power units

A new line of versatile 1,000 and 2,000 psi single pump hydraulic power units with a working capacity conversion feeder feature. They are available with reservoir capacities from 15 to 60 gallons and pump capacities to 35 gpm. All standard units are equipped with a separate relief valve and incorporate an 1,800 rpm motor. Single pump power units are useful in hydraulic applications requiring maximum service and minimum maintenance. **TEM Sales Limited.**

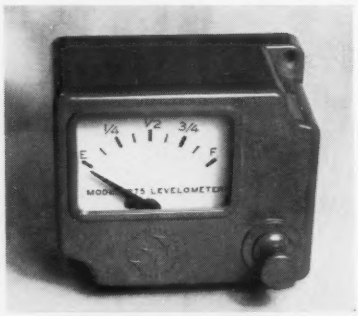
Circle 339 on Reader Service Card

Checking unit

A new hydraulic checking unit with oil filled checking cylinder, checking piston, metering valve and reservoir cylinder providing a positive counter force to the action of air or hydraulic operated cylinders. It is claimed to have a uniform work-stroke, precise pre-set feed right and can easily be set for any sequence of rapid transverse, stop, skip and variable feed controls. Available in checking ranges of 3,000, 2,000, 1,500 and 800 pounds. **Fluid Power Limited.**

Circle 340 on Reader Service Card

Level gauges



A new line of liquid level gauges with responsive hydrostatic operation requiring no electrical power. Developed as a remote reading dial type instrument at a moderate price, the gauges are suitable for light liquids such as water, gasoline and diesel fuel. Models are available for standard tanks from 23 to 72 inches in depth. **W. K. Davidson & Co. Ltd.**

Circle 341 on Reader Service Card

Double flow regulator

A new pressure compensated double flow regulator featuring twelve position detents, dustproof dial adjustments and bottom-located ports for simplified installation. It incorporates two combination bypass and restrictive-type flow regulators in series in a single body. **Rousseau Controls Ltd.**

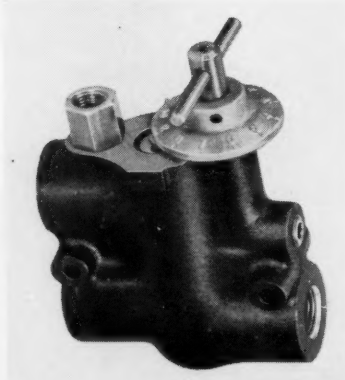
Circle 342 on Reader Service Card

Reusable fitting

A new type of detachable, reusable fitting for high pressure hose assemblies. Designed especially for industrial markets such as construction equipment and heavy automatic machinery the fitting is recommended for a wide variety of high pressure hydraulic and pneumatic applications as well as for fuel and lubrication systems. Basically the fitting consists of three components: (a tapered steel socket which is pushed over segments during assembly and forms a rugged compression fitting that won't blow off; two aluminum segments which grip hose reinforcements securely and mate with nipple assembly for correct positioning; a steel nipple which fits into a hose and does not cut the hose inner tube. **Aeroquip (Canada) Ltd.**

Circle 343 on Reader Service Card

Divider valve



A priority type flow divider valve with dial actuated flow control. A new feature is the manually operated detent positioned indicator dial that permits selection of up to ten different rates of flow

(Continued on page 86)

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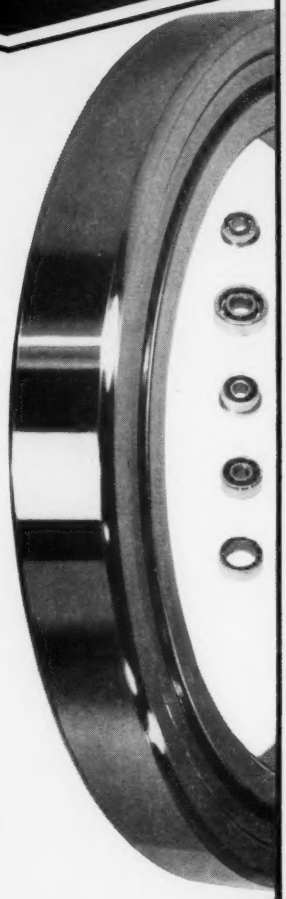
NEW DEPARTURE BALL BEARINGS



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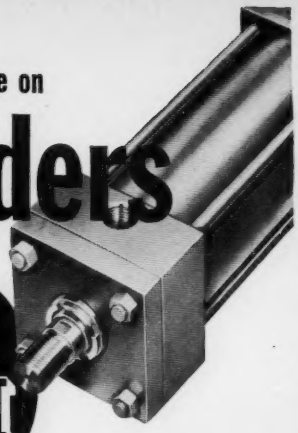
for FAST service on

cylinders

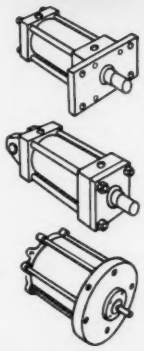


CALL TEM

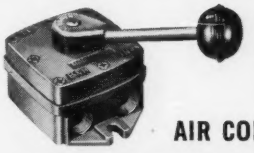
deliveries from stock of famous

HANNIFIN

air and hydraulic cylinders in most popular sizes.



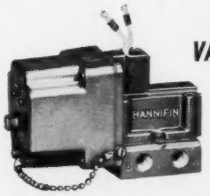
Cut-down time to a minimum! Call TEM for famous Hannifin cylinders—in sizes from 1″ to 12″ bore—capacities up to 2,000 PSI. Hannifin hydraulic cylinders offer new J.I.C. standard straight threads for leak-proof connections. Hannifin Cylinders mean longer life, less maintenance. Write for our complete catalogues.



Now—a smaller better, lower cost 4-way disc type

AIR CONTROL VALVE

The Hannifin "LAP SEAL" valve—a new arrangement of 6 simple parts. Foolproof assembly—interchangeable discs give selection of *two* operating types of valves. Handle mounts in any 90° position. Write for literature.



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The Hannifin Series CC 4-way valve for simplified piping lay-outs. Integral speed control section available for low cost cylinder speed control—11 different operating heads.

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for a constant delivery pump. The dial can be set to provide accurately calibrated increments of controlled flow to meet specific capacity requirement of the motor fluid in excess of the amount delivered to its controlled flow port. **Fawick Corporation.**

Circle 344 on Reader Service Card

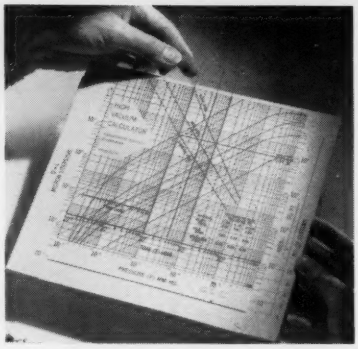
Epoxy pipe coating

A new pipe coating claimed to be easier to apply than conventional mill coatings. Welding of pipe sections can be accomplished through the resin coating once an arc has been struck on a bare spot. **Minnesota Mining & Manufacturing of Canada Ltd.**

Circle 345 on Reader Service Card

Vacuum calculator

A slide-rule-type high vacuum calculator useful in determining pump or chamber size color as well as time and pressure, for high vacuum systems. It is claimed to be the first calculator available for the high vacuum range. An over-all size of



8½x11 inches it consists of two heavy gauge slides held in place by a rigid vinyl casing. Either slide can be used to solve numerous simple vacuum problems.Together they are capable of solving a great many complex high vacuum problems. **Consolidated Vacuum Corp.**

Circle 346 on Reader Service Card

Cylinder calculator

A useful calculator available free of charge which enables the user to read directly the available thrust if the cylinder diameter and air pressure are known. Similarly the calculator can be used to determine necessary cylinder diameter or pressure required. Two thrust readings are given—actual static thrust and useable thrust of a moving cylinder (80% of actual thrust). **Martonair (Canada)**

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Non-corrosive meters

Stainless steel meters with an oscillating piston that measure the flow of liquids which normally corrode other metals. Suitable for use in chemical and paper plants, drug companies, and liquid fertilizer suppliers. Claimed to have an ac-

(Continued on page 88)

ALIKES"

Gaskets often look similar. But the important point is—what are they designed to do?

Today's complex problems of sealing call for a thorough knowledge of gasket materials and although this is important, factors such as joint design, temperature, effect of contained fluid and environmental conditions must also be considered.

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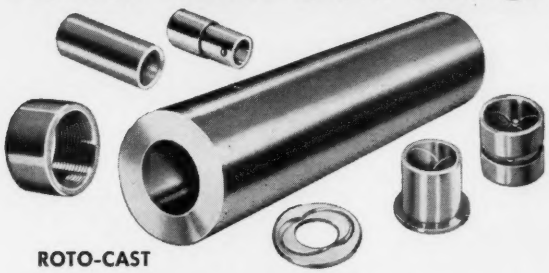

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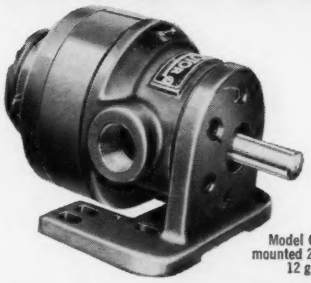

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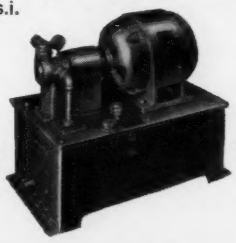

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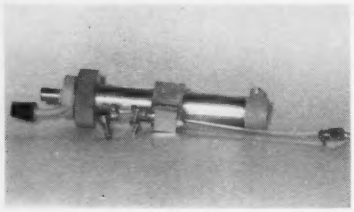

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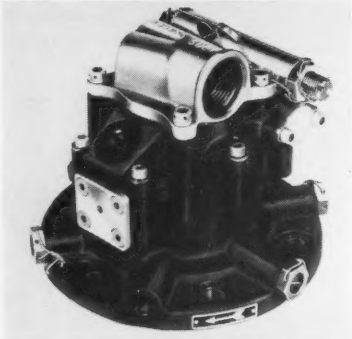

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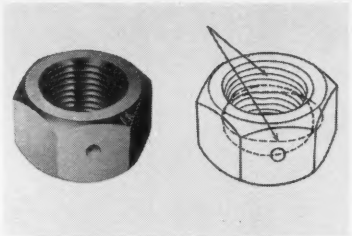

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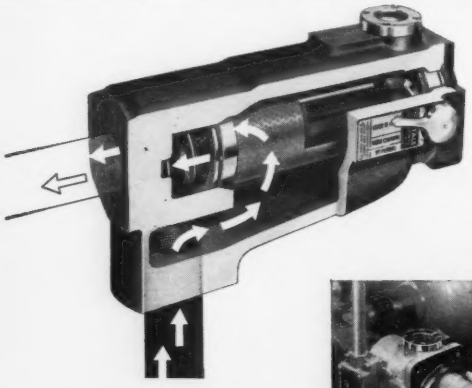

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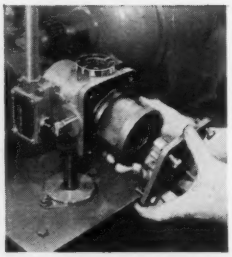

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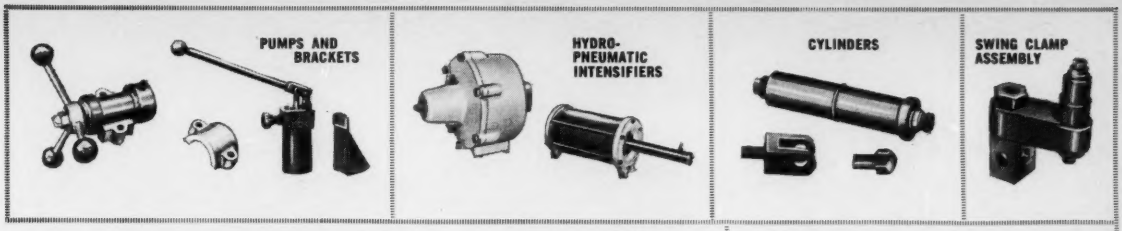

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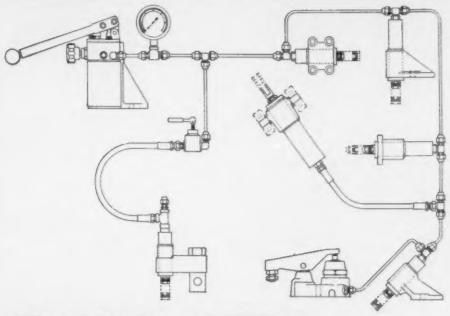

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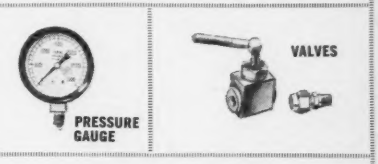

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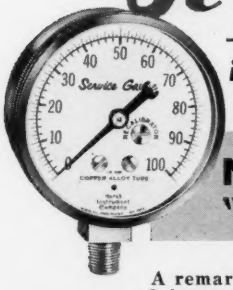

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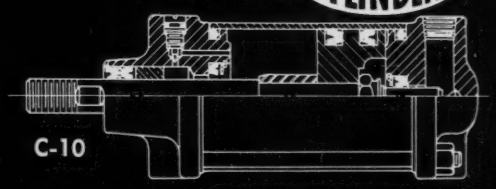

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Bricklayer designs a concrete saw

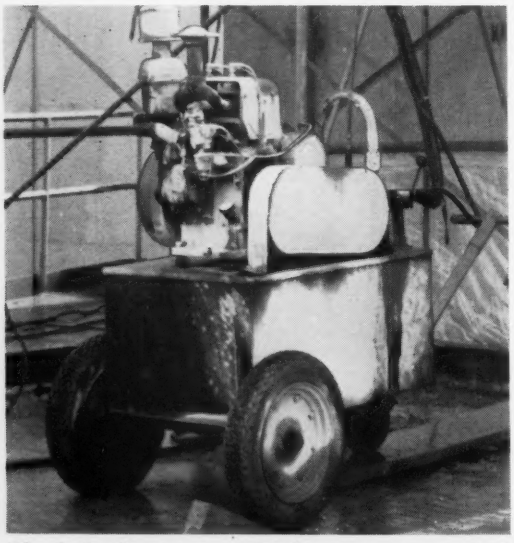
A hydraulic-powered concrete saw, designed in Vancouver, should provide the construction industry with a cost reduction tool

An hydraulic motor powers this saw blade which is biting into a concrete wall.

Cutting a hole in a concrete wall has always posed a problem for construction men. But a Vancouver bricklayer has harnessed an hydraulic motor to power a new saw rig that may provide the answer to some of the main standing problems.

Inventor James Doyle found his idea so much in demand he has now left bricklaying and has opened a concrete-cutting and diamond-drilling business at East Georgia Street, Vancouver, trading as J. T. Doyle Ltd.

Doyle uses a diamond-toothed saw that slices through a vertical concrete face as it runs along a guide track fastened to the wall by bolts or suction cups. The blade is powered by a small hydraulic motor weighing 36 lb and driven by an 18 hp gas-motor located on the nearest horizontal surface.



The hydraulic motor on Doyle's concrete saw rig is powered by this 18 hp gas motor which can be located on the nearest horizontal surface.

The new saw rig resulted from a determination to do away with the slow, untidy and expensive methods in conventional use. To show what he means, Doyle quotes the case when he was engaged to cut a window in a new concrete-faced building on the University of B. C. campus. Use of jack hammer was forbidden because of dust and noise, so he had to turn to the diamond-drilling method at a cost of $700.

"There must be a better way," thought Doyle. And there was. He began working on a saw that could be easily manipulated.

An electric motor powerful enough to drive the saw would have been too heavy. A gasoline motor would have been lighter but suitable only in an upright position. Then Doyle struck on the idea of an hydraulic motor connected by hydraulic lines to a separate power source.

He made an eight-foot guide track to the saw and its motor on a ball-bearing assembly. Two screws at either end, with a chain and ratchet control, regulate the saw's bite into the concrete. Turning a handle inserted into the end of one of the screws enables the operator to move the saw in or out of its cut. The saw moves along its track on a long screw which can be activated by another handle.

In all, the saw rig weighs less than 240 lb and can be easily manœuvred by two men.

The design and development took two months and Doyle worked without drawings. He has applied for patents and is now testing his idea on numerous jobs before considering manufacture.

The new concrete saw can slice through an eight-inch concrete wall at six inches a minute. The idea is to cut through to within a quarter of an inch of the inner wall and chip out the remaining material. It can then be removed by block and tackle.

And Doyle claims the B. C. University campus job, with his invention, would have cost only $80. ★

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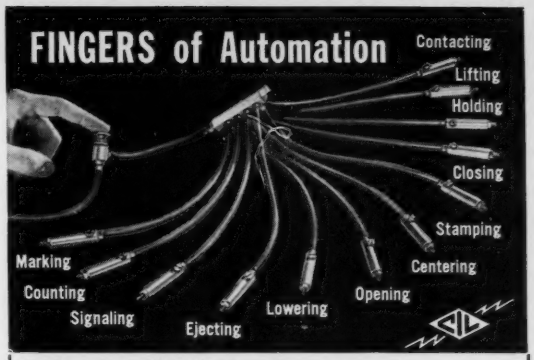

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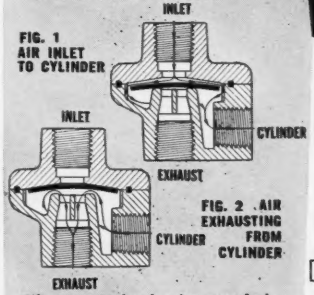
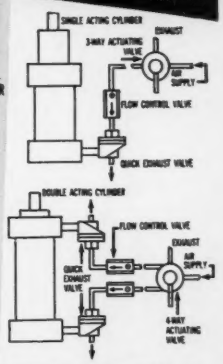


FIG. 1 AIR INLET TO CYLINDER

FIG. 2 . AIR EXHAUSTING FROM CYLINDER

When control valve is opened air pressure seals exhaust port and diaphragm is deflected permitting air to pass thru the cylinder port (Fig. 1). When inlet pressure is relieved (by actuating valve in control circuit) the buildup of cylinder return pressure closes inlet port (Fig. 2) snapping the diaphragm off the exhaust port allowing instantaneous evacuation of exhaust air. *Write for complete details, specifications and prices.*



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backlash

Why buy Canadian?

The President of the Canadian Manufacturers' Association, T. R. McLagan, O.B.E., struck an alarming note at the general business session in Vancouver last month. He compared Canada's reliance on imported goods with that of other industrialized nations, and Canada came out with a very poor showing.

In 1959, on a per capita basis, every man, woman and child in Canada bought $244 worth of goods which were fully manufactured outside the country. This was 4.7 times the amount of such goods imported by Britain, 4.9 times that of West Germany, 6.4 that of the United States, and as much as 27 times the figure for Japan.

Surely Mr. McLagan's "story in a nutshell" is the CMA's strongest case for its "Buy Canadian" campaign. In view of Canada's unemployment problem Mr. McLagan is right in calling this reliance on imports both excessive and inexcusable. One of the worst aspects is that many of the products which send the import bill sky-high each year are already produced in Canada. Most that are not produced in Canada could be.

Wanted abroad: engineers

In this issue of DE there are several references to the increasing importance of an engineer's role in economics. An engineer, today, must make the initial contribution to the cost and quality of the product he designs. He must all but don the clothes of an economist.

But there's an even more sweeping economic task for the engineer. The world's underdeveloped countries are crying out for engineers and scientists who can contribute just as much as the physician or the educator.

The most recent appeal for engineer "missionaries" has come from Paul G. Hoffman, managing director of the United Nations Special Fund. This is what he said to "Engineer", the official journal of the U.S. Engineers' Joint Council: "Assisting the underdeveloped countries is the task of starting, almost from scratch, to build modern economic structures in the poorer countries of the world. It is a job for decades."

This particularly concerns engineers who are "largely responsible for this 'revolution of rising demands', more responsible for it than the politicians or the traders. It is the genius of engineers in the laboratory, factory, and field that has brought about the tremendous surge toward prosperity and greater comfort which we in the industrialized part of the world enjoy. (This) awakened the sleeping masses . . . that a better life could be theirs."

Although there are already a large number of engineers in the UN's technical assistance teams, the programs must be stepped up now if the reasonable demands for better living are to be satisfied for two thirds of the world's population.

Mr. Hoffman's appeal followed closely on the heels of a UNESCO plea for a number of highly specialized engineering teachers for field duties in Asia, Africa and Latin America.

With so great a demand for engineering skill, the big problem is where to find the talent. One recent suggestion came from William V. Kahler, president of the Illinois Bell Telephone Company. He proposed that the great reservoir of retired engineers be tapped for leadership in technical phases of President Kennedy's Peace Corps.

This is an idea worth following through by engineering societies. There are sure to be many Canadians who would like to put their retirement to good use. Canada has a very good record so far in supplying technical assistance for UN foreign aid programs.

Design is poorly paid

Design engineers are the lowest paid of any class of engineer in Canada.

This is the stark, but true, conclusion reached in a coast-to-coast survey of engineers' and scientists' salaries. During the first quarter of 1961 the Canadian Department of Labour mailed questionnaires aimed at providing some means of comparison for annual salaries.

The answer: median salary in engineering and science at the beginning of the year was $8,100. Twenty-five percent of those surveyed were being paid $6,700 or less and another twenty-five percent $10,000 or more. The top ten percent were earning more than $12,700 while the bottom ten percent received below $5,700. But generally speaking engineers were better paid than scientists.

The survey broke down the engineering salaries by job function, only to prove that design engineers earned an average of $7,700, while the salary for R&D and operation, production and maintenance engineers was $8,100. Executive and administrative engineers earned an average of $10,800.

And to make matters worse it also revealed a big discrepancy between the salaries of Canadian and U.S. engineers. Canadians, generally speaking, received about $1,500 less than their U.S. counterparts.

Let's not rush

The Engineer's Confederation Commission has made its final report on the proposed merger of the two main organizations representing about 40,000 professional engineers across Canada. It was presented at the annual meeting of the Engineering Institute of Canada in Vancouver, May 31 and to the Canadian Council representing the various Associations of Professional Engineers, in Edmonton, June 7.

The report made no recommendation for confederation, but included a proposed constitution, by-laws and legal details. It also recommended that Ottawa be the headquarters site for any new combined organization. But the suggestion that an amendment to the present E.I.C. charter might provide the means for a new constitution must be much more fully investigated. It is no simple matter.

There has been much clamoring, and rightly enough, about the delay in bringing about a merger. But a marriage as important as this, and with so many far-reaching consequences, does not warrant a hasty decision. Those who will have to determine any follow-up action to the latest report would do well not to rush.

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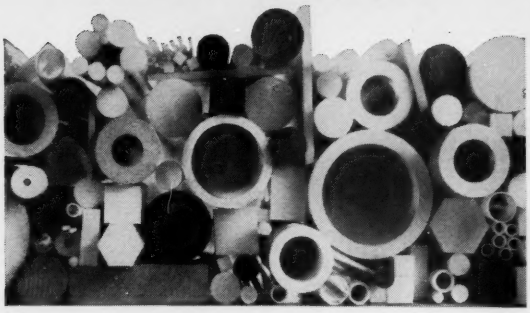

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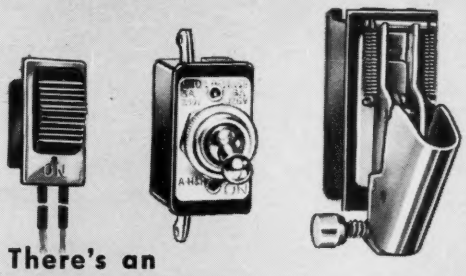

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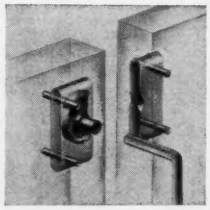

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Editorial

A chance for fame and fortune

. . . but you will have to get your entries in without delay

There's still time to enter . . . .

. . . . that is, time to enter two of the most important design contests ever opened to Canadian engineers and designers. **We commend both to your attention.**

Take, for instance, the Gray Iron Founders' Design Contest. The rules are simple — there is no entry fee — and the prizes are well worth trying for. This Design Contest is an annual competition to stimulate interest in the vast range of design possibilities provided by the versatile and economical gray and ductile irons.

This year's contest closes July 15 . . . but there is still time for you to get an entry ready and submit it. Cash prizes totalling $850 will be awarded, together with handsome citations. Winners will receive international recognition through the trade press.

It's easy to enter the contest. Simply select your best gray or ductile iron casting design, describe it on an entry blank (obtainable by writing to the sponsors, or this magazine) and mail the entry blank and photograph of the design to the Gray Iron Founders' Society, National City-East Sixth Building, Cleveland 14, Ohio, before July 15.

Although no Canadians have ever won the major awards in this competition, there have been some honorable mentions. Since the awards will be presented in Toronto this year at the annual conference in October, this is the logical time for Canadian engineers to really make an effort to win.

The second contest in which we want to see plenty of entries is the Stainless Steel Design Award, the contest about which we commented editorially last month. Coupled with direct action by the industrial design associations in Canada, our protests of last month have brought some revisions in the terms of reference for the competition.

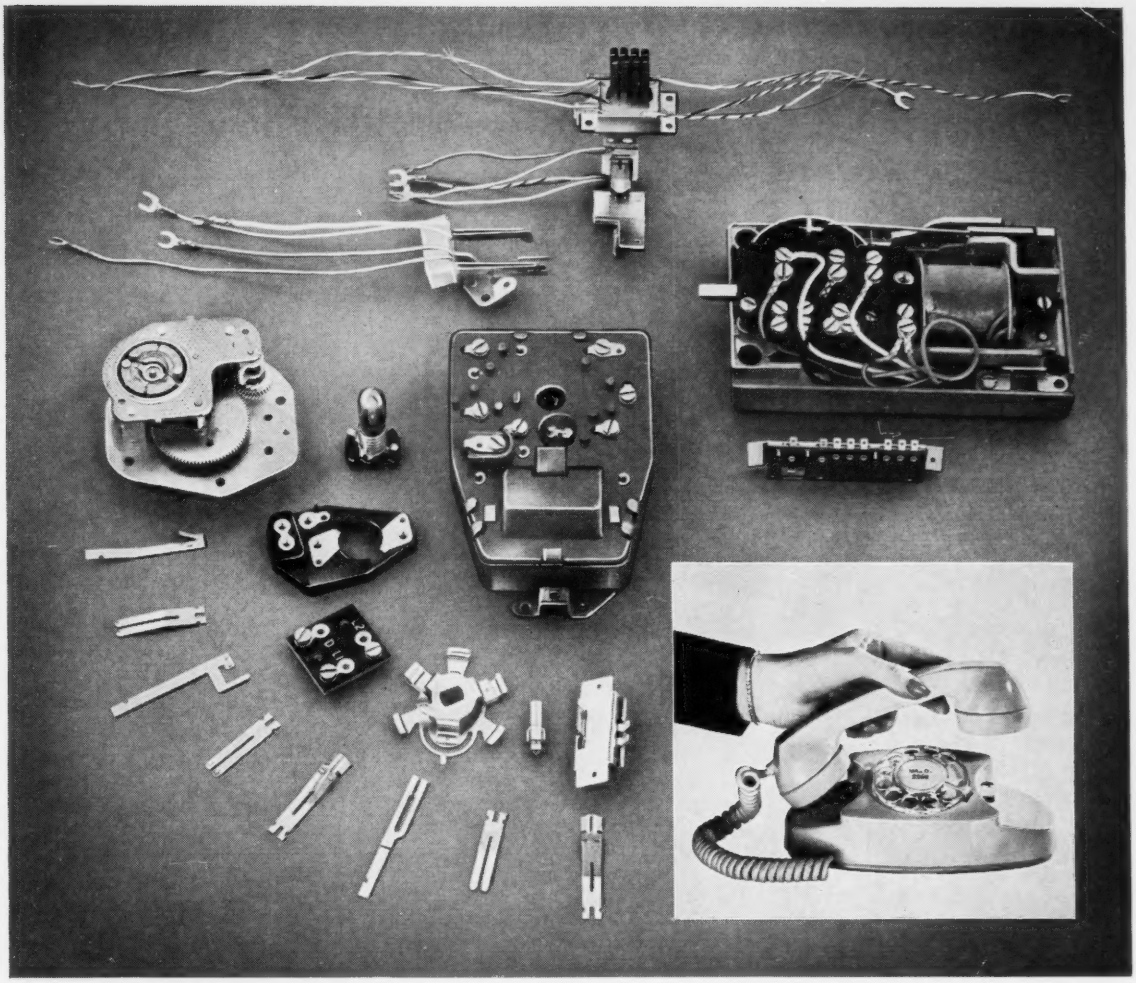
This refers, of course, to Category 2, and covers "items of original Canadian design (not earlier than 1960) that employ stainless steel and which could conceivably be found in a branch bank building." The jury will now consist of an architect (other than the professional adviser), an interior decorator, **and an industrial designer to be selected by the directors of the Association of Canadian Industrial Designers.** Prizes in this contest will total $2500.

Whereas it had been the intention of the designers not to enter the contest since they considered it to be "unprofessional" as originally constituted, a letter from the directors of the association dated June 9th and addressed to all members of the ACID and APIDO says *"Should you decide to enter the competition — and we hope you do — give it all you've got! We want designers to win all the awards."*

Registration in this design contest closes August 1, with entries due by September 25. Details of the competition are available from Prof. E. R. Arthur, School of Architecture, University of Toronto.

So . . . as we said at the beginning . . . there's still time to enter both of these design competitions. But you will have to hurry.

Doug Kaill



Many integral parts of Northern Electric's Princess model telephone are made from copper and its alloys. The Ringer, for example, which permits the subscriber to adjust the loudness of the ring, uses copper and brass and the principal coil is copper wire. Contact springs and contacts of phosphor bronze, have exceptional resilience and strength. Other vital components are made of nickel silver.

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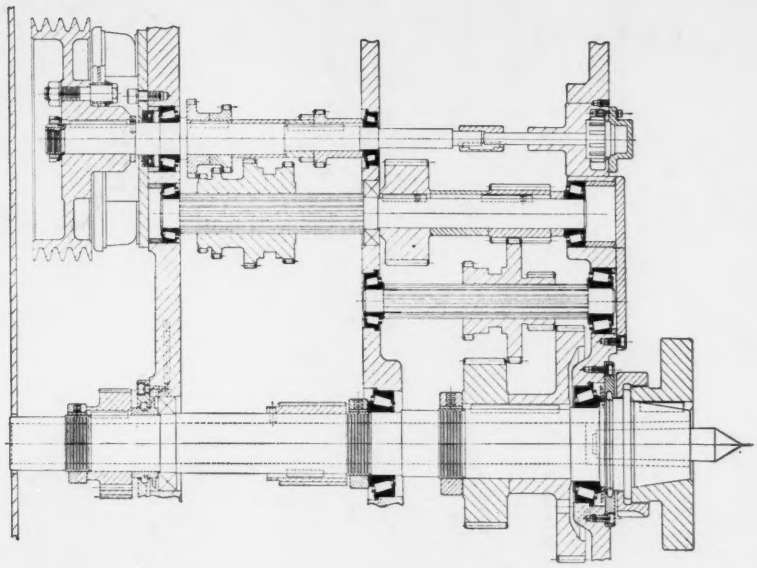
PAGES 95-96 MISSING READER'S SERVICE CARD.

LeBLOND lathe obtains super spindle-runout of less than .000025″ with Timken "00" bearings



To raise the already great precision of its 15″ Dual-Drive lathe to a special new high for a customer, LeBlond had to meet this requirement: spherocity of the part to be turned—a beryllium gyro float assembly—had to be concentric with its two major axes within .0005″ total indicated runout. Diameter of the sphere: 1.8750″.

To assure this, LeBlond engineers specified Timken super-precision "00" tapered roller bearings held to .000025″ assembled runout for the spindle—one-third the normal runout tolerance for these bearings. Timken bearings were also used on the intermediate, back and feed shafts of the drive. The assembled spindle runout (total indicator reading) was actually less than .000025″.

Producing super-precision bearings like this is typical of Timken Company service. The kind of service that developed Timken "00" bearings to meet industry's needs for ever-greater precision. It's another example of the Timken Company's leadership in tapered roller bearing design and manufacture.

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